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JOURNAL

OF THE

INSTITUTE OF ACTUARIES.

"I hold every man a debtor to his profession, from the which as men of course do seek to receive countenance and profit, so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereunto."—BACON.

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CONTENTS OF VOL. XXV.

PAGE

The Royal Charter of Incorporation of the Institute of Actuaries 1

On the Graduation of Mortality Tables. By John Adams Higham, Fellow of the Institute of Actuaries 15

Notes on Friendly-Society Legislation 24

Discussion on the Report of the Royal Commission on Friendly Societies ... 36

On the Rate of Mortality in the Navy. By Thomas Bond Sprague, M.A., President of the Institute of Actuaries 49

On Mortgages of Reversionary Interests. By Henry Godefroi, LL.B., B.A., Barrister-at-Law, Author of the "Law of Trusts", and Joint-Author of the "Law of Railway Companies" 55

Opening Address by the President, Thomas Bond Sprague, M.A., F.I.A., F.R.S.E. 65

Some Account of the Census, from 1801 to 1881. By Arthur Francis Burridge, F.I.A., F.S.S., of the Equity and Law Life Assurance Society 83

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A. 114

On the construction of Models of Policy-Values, and on a new method of comparing the Reserves for Policies, according to different Tables of Mortality and Rates of Interest. By James Chisholm, F.I.A., Manager and Actuary of the Imperial Life Insurance Company 141

Abstract of the Discussion on the preceding 155

On the Probability that a Marriage entered into at any age, will be Fruitful; and that, if a Marriage has been Childless for several years, it will afterwards become Fruitful. By Thomas Bond Sprague, M.A., President of the Institute of Actuaries 160

Abstract of the Discussion on the preceding 176

Office Premium Loadings, and how they are dealt with under the various methods of Valuation and modes of Distribution of Profits. By George Stephen Crisford, Fellow of the Institute of Actuaries, and Actuary to the Rock Life Assurance Company 184

Abstract of the Discussion on the preceding 202

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A.—(*continued*) 207

Notes on Friendly-Society Legislation 216

171100

PAGE

On the Rates of Mortality among the Natives of India. By George Francis Hardy, F.I.A., F.S.S. 217

Abstract of the Discussion on the preceding 238

On the Graduation of Mortality Tables. By John Adams Higham, Fellow of the Institute of Actuaries—(*concluded*) 245

Report of the Medical Director (Dr. Thomas A. Foster) of the "Union Mutual Life Insurance Company", Portland, Maine, upon the Death Losses for the eight years ending 31 December 1884 251

History of Life Insurance in the United Kingdom. By Cornelius Walford, F.I.A.—(*continued*) 257

The Life Assurance Companies of the United Kingdom 271

Opening Address by the President, Thomas Bond Sprague, M.A., F.I.A., F.R.S.E. 293

On the Income Tax, especially in reference to its Incidence on Assurance Companies. By Arthur Hutcheson Bailey, F.I.A., F.S.S., Actuary to the London Assurance Corporation 314

On Average Rates of Mortality as affected by the Grouping of the Numbers exposed to Risk at different Ages. By William Thomas Gray, of the Scottish Equitable Life Assurance Society, Fellow of the Institute of Actuaries 369

On Office Premium Loadings, and how they are dealt with under the various methods of Valuation and modes of Distribution of Profits. By George Stephen Crisford, Fellow of the Institute of Actuaries, and Actuary to the Rock Life Assurance Society—(*continued*) 387

On the Assessment of Life Risks. By James Chisholm, Fellow of the Institute of Actuaries, Manager and Actuary of the Imperial Life Insurance Company 408

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A.—(*continued*) 433

ACTUARIAL NOTES:

On the Value of the Option of Second Nomination in Reversionary Annuities. By George Francis Hardy, F.I.A. 134

Value of Endowment Assurance on Joint Lives 136

On the Rate of Mortality in Central Africa. By Thomas Bond Sprague, M.A., President of the Institute of Actuaries 437

OBITUARY:

The late William Barwick Hodge 367

" Major-General J. C. Hannyngton 367

" Cornelius Walford 367

" Elizur Wright 367

PAGE

REPRINTED ARTICLES:

State Supervision in Insurance. (From a paper read by Mr. Richard Teece before the Insurance Institute of New South Wales) 350

CORRESPONDENCE:

Letter from Mr. William Sutton on Errata in the *Institute of Actuaries' Text-Book*, Part I 63

Letter from Mr. Thomas Bond Sprague on the Solution of a Problem ... 277

" " on "Asset"—"Outgo" 366

Letter from Mr. James Chatham on Assurances on x against y and t years longer 439

Letter from Mr. Gerald H. Ryan on the Analogy between an Annuity-Certain and a Life Annuity 443

NOTICES OF NEW BOOKS:

Memoir of Augustus De Morgan 137

LAW REPORTS:

Last *v.* The London Assurance Corporation 327

INSTITUTE OF ACTUARIES:

Preliminary Examination, 1885 278

Intermediate " " 281

Final " " 284

Proceedings of the Institute, Session 1884-85 287

Annual Report 289

Income and Expenditure for the Year ending 31 March 1885, and Balance Sheet, 31 March 1885 291

ORIGINAL TABLES:

J. Chatham. Contingent Premiums. Values of $\varpi^1_{x:\overline{y(t)}} - \varpi^1_{xy}$, $\frac{A^1_{x:\overline{y(t)}}}{a_{xy}} - \varpi^1_{xy}$, ϖ^1_{xy}, and A^1_{xy} (H^M 4 per-cent) 439

MISCELLANEA:

New Publications in 1885 368

Errata 368

JOURNAL

OF THE

INSTITUTE OF ACTUARIES

AND

ASSURANCE MAGAZINE.

The Royal Charter of Incorporation of the Institute of Actuaries.

We have the satisfaction to announce to our readers that the Institute of Actuaries has at last received the grant of a Royal Charter of Incorporation. The Charter is dated 29 July 1884, and will be found reproduced *verbatim* at the end of these remarks.

It may be of interest to many of our readers to give a short history of the various proceedings from time to time in connection with the subject of the incorporation of the Institute of Actuaries.

Soon after the Institute was established in 1848 the question of its incorporation was discussed, and in the first number of the *Journal* (September 1850),—or, as it was then called, the *Assurance Magazine*,—is given a draft "Bill for regulating the Profession and Practice of Actuaries throughout Great Britain and Ireland", introduced by remarks from which we extract the following:

The formation of the Institute of Actuaries has, no doubt, tended in a great degree to afford the profession and the public the kind of protection which, in all the relations existing between them, both have stood so much

in need of. The mere enrolment of the names of its members will, in future, serve to indicate at least a large portion of the profession; whilst the existence of such an organized body will, it is probable, prevent unskilled and incompetent persons assuming a name and functions to which neither their education nor acquirements give them any sufficient title. But more is still required! That the Institute will soon aggregate all the existing members of the profession, and that it will hereafter send forth a new race of even more competent men than have heretofore entered upon the field, there is little room to doubt. But then the permanence of the Institute itself must be secured; in like manner the probability of the intrusion of unfit persons into the profession is less than heretofore,—but such intrusion must be absolutely prevented—and these objects, it is obvious, can only be obtained by the aid and sanction of the Legislature. After a good deal of careful consideration, we have, with the kind assistance of legal friends, endeavoured to lay down the general outlines of a Bill which, as it appears to us, would be calculated, if passed into a law, to accomplish the objects in view; and we submit it accordingly to the members of the profession, hoping that they may be induced to give their attention to its details, and should they be approved, their help towards its completion. It will be seen that the Bill provides, in the first place, for the enrolment, without expense, of the names of all the approved members of the profession, whether of the Institute or not. It then proceeds to effect the incorporation of the Institute, and embodies its *present* laws and constitution. The creation and registration of future members, and the terms of their admission to practice, is then provided for. The infliction and recovery of penalties for improper assumption of an Actuary's functions, occupy a few clauses, and the document concludes with an explanation or definition hitherto so much wanted, of the precise nature and character of those functions.

Then follows the draft Bill, to which we can only refer our readers. In the third number of the *Assurance Magazine* (April 1851), p. 264, are indicated the difficulties standing in the way of the Bill; and little, if anything, more appears to have been heard of it.

At a special general meeting of the members of the Institute, held in April 1853, in reference to the Select Committee (appointed by the House of Commons) on Assurance Associations and the Act of 1844, three resolutions were passed, of which one was as follows:

> That, in the opinion of this Meeting, no legislation on Life Assurance Associations can be permanently effective that does not exact tests as to the respectability and acquirements of persons allowed to practise as Actuaries.

In vol. iv of the *Journal of the Institute*, the Report of the Select Committee is given *verbatim*, and attention is called by the editor, the late Mr. Jellicoe, to the last paragraph of that Report, which runs as follows:

Your Committee will conclude their Report by calling attention to a part of the evidence which advocates the formation of an incorporated Society of Actuaries, with a view to the advancement of that (*sic*) important science, and also with a view to issue diplomas or certificates to persons qualified to practise as Actuaries. If any effort should be made to induce Parliament to grant such an incorporation, the Committee are of opinion that it will be worthy of consideration; but that further investigation would be needful before such measures should be adopted, *as considerable difference of opinion prevails on the subject among Actuaries themselves.* (The italics are those of the then Editor of the *Journal.*)

The Editor of the *Journal* added a footnote to this quotation, which will be found on p. 32, and to which we refer our readers.

On at least two occasions since that Report of the Select Committee, the difficulty as to who is and who is not to be considered an actuary for the purposes of legislation has been conspicuous, namely, in connection with the Life Assurance Companies' Act, 1870, and the Friendly Societies' Act, 1875; and on each occasion no attempt was made by the Legislature to remove that difficulty, mainly from the reason hinted at in the paragraph of the Report of the Select Committee just quoted, that "considerable difference of opinion prevailed on the subject of the incorporation of the Institute among actuaries themselves." To those of our readers who are familiar with the early history of the Institute of Actuaries, the words just quoted indicate a state of affairs which now happily no longer exists.

The question of the incorporation of the Institute was again brought before, and carefully considered by, the Council of the Institute at their meetings in the early part of 1882, and it was agreed to present a recommendation to the Annual General Meeting in favour of such incorporation. Accordingly, at the Annual General Meeting held on 3 June 1882, such a recommendation was made by the Council and unanimously approved, and the Council was requested to take the necessary steps towards obtaining a Charter of Incorporation.

At Special Meetings of the Council the draft Charter and accompanying Petition were considered and settled, and were presented to Her Majesty's Most Honourable Privy Council on 15 September 1882.

It should here be remarked that for many years past the prerogative of the Crown as to the grant of Charters of Incorporation had been very rarely exercised, owing to the fact that the various Joint-Stock Companies' Acts supplied a machinery by which incorporation could be obtained; and in consequence a

custom arose of referring all applications for the grant of a Royal Charter of Incorporation to the Board of Trade for a Report. Just previous to the presentation of the Institute's petition, the Board of Trade had had referred to it similar petitions from the Institution of Surveyors and the Institute of Accountants, and had, as usual, been disposed in the first instance to recommend incorporation under the Companies' Acts, with the privilege of omitting the word "Limited." To this course it was objected that examining bodies could hardly be properly constituted as joint-stock companies with share-capital, shareholders, &c., and the Board of Trade ultimately agreed to this view of the subject.

The application of the Institute of Actuaries was referred by the Privy Council Office to the Board of Trade in the usual way; and it then transpired that, some time before the presentation of the Institute's petition to the Privy Council Office, an objection had been lodged by the Actuaries' Club with the Board of Trade. Thus, nearly thirty years after the Select Committee of the House of Commons had reported that in reference to the incorporation of the Institute of Actuaries "considerable difference of opinion prevailed on the subject among actuaries themselves", it became evident that this difference of opinion had not ceased to exist.

The opposition of the Actuaries' Club led to an unfavourable report, in the first instance, from the Board of Trade; but, on its being represented to the Privy Council Office that, under the Friendly Societies' Act, the Treasury had important duties imposed upon it in connection with actuarial matters, the Institute's application was, we believe, referred to the Treasury to report upon. From various causes, as to which it is now unnecessary to make any further mention, this second reference proved abortive; and now came a long and anxious time, during which negotiations were being carried on calling for the exercise of great tact and judgment on the part of those members of the Institute who had charge of them. These negotiations were ultimately successful, and, as already stated, the Institute of Actuaries became incorporated by Royal Charter on 29 July 1884.

It will be seen that under and by virtue of the Charter, the members of the Actuaries' Club become Fellows of the Institute of Actuaries, so that the whole actuarial profession in England may now be said to be included in the corporate body known as the Institute of Actuaries.

We would particularly call the attention of our readers to the terms of the Petition for the grant of a Royal Charter of Incor-

poration, and would only add that as the Faculty of Actuaries in Scotland has for some years past been incorporated in a similar way, there should in a few years be little difficulty in the Legislature, Courts of Law, and the public generally recognizing the legal status of the two bodies, and the actuarial competency of their members.

Pursuant to the provisions of the Charter, the first meeting of the Council of the Institute of Actuaries was held at Adelphi Terrace, London, on 12 August 1884.

THE CHARTER.

Victoria by the Grace of God of the United Kingdom of Great Britain and Ireland Queen Defender of the Faith

TO ALL TO WHOM THESE PRESENTS SHALL COME GREETING:

WHEREAS an Humble Petition has been presented to us in Our Council by THOMAS BOND SPRAGUE, MARCUS NATHAN ADLER, GEORGE WILLIAM BERRIDGE, CHARLES JOHN BUNYON, and RALPH PRICE HARDY setting forth to the effect following:

That the Petitioner THOMAS BOND SPRAGUE is the President and the Petitioners MARCUS NATHAN ADLER, GEORGE WILLIAM BERRIDGE, CHARLES JOHN BUNYON, and RALPH PRICE HARDY are the Vice-Presidents of an Association established in London in 1848 called the Institute of Actuaries of Great Britain and Ireland.

That the Institute of Actuaries was established for the objects following—that is to say:

(*a*) For the purpose of elevating the attainments and status and promoting the general efficiency of all who are engaged in occupations connected with the pursuits of an Actuary.

(*b*) For the extension and improvement of the data and methods of the science which has its origin in the application of the doctrine of probabilities to the affairs of life and from which life assurance annuity reversionary-interest and other analogous institutions including friendly societies derive their principles of operation.

(*c*) The consideration of all monetary questions involving separately or in combination the mathematical doctrine of probabilities and the principles of interest.

That the profession of Actuary is one requiring a wide and varied training in respect of the frequent employment of its members in the several capacities of expert witnesses valuers and advisers in matters relating to financial questions particularly in reference to those numerous and important questions involving the scientific application of the doctrine of probabilities and the principles of interest.

That the profession of Actuary is one which has already imposed upon it by various Acts of Parliament more particularly by the Life Assurance Companies' Act 1870 and by the Friendly Societies' Act 1875 and previous Acts relating to Friendly Societies specific and important duties.

That the representative character of the Institute of Actuaries and the position which its members occupy in relation to public interests have been already recognized in the ways following:

(*a*) In the year 1852 the then Registrar of Friendly Societies consulted the Institute as to the preparation of sickness and mortality tables from the Quinquennial Sickness and Mortality Returns made by Registered Friendly Societies under the Friendly Societies' Act then in force.

(*b*) In the year 1871 the Board of Trade consulted the Institute with reference to the proper method of carrying out some of the details of the Life Assurance Companies' Act 1870.

(*c*) In the year 1874 the then Chancellor of the Exchequer consulted the Institute with reference to certain provisions to be inserted in the Friendly Societies' Act which was passed in the year 1875 and also with reference to the preparation of tables for Friendly Societies.

That the profession of Actuary is one to which important matters are frequently referred by the Chancery Division of the High Court of Justice and other Legal and Administrative Departments of the State.

That the Institute of Actuaries aims at improving the status of Actuaries providing means of professional training and the interchange and dissemination of practical information thereby securing the better discharge of duties affecting interests of great importance.

That the Institute of Actuaries has already collected and published extensive data relating to mortality statistics and has also caused to be calculated therefrom and published various

monetary tables which have been largely adopted by the Life Assurance Institutions of this and other countries.

That the Institute of Actuaries has already by means of its published Transactions known by the name of the *Journal of the Institute of Actuaries and Assurance Magazine* which in greater part consists of contributions from its own members during the last thirty-two years disseminated valuable information theoretical and practical with the result of constituting the said Journal the leading source of information in this and other countries on matters relating to the profession of Actuaries.

That the Institute of Actuaries has already caused to be written and published for the use of the profession of Actuaries and others a Text-Book of the Principles of Interest including Annuities-Certain constituting the first part of a complete treatise on Actuarial Science.

That the Institute of Actuaries has already by means of the important educational functions and system of examinations with which it has charged itself during the last thirty-two years including the establishment and superintendence of classes of instruction conducted by persons appointed by the Institute largely contributed to the better discharge of duties affecting interests of great importance.

That the Petitioners are advised and believe that the Incorporation of the Members of the Institute of Actuaries under our Royal Charter would tend greatly to the attainment of the objects which it has in view and would be fruitful of public advantage by enabling the Institute to take more effective measures for securing the adequate training of Actuaries in the duties of their calling and by according to the Institute a position by means of which it would be better able to exercise an influence towards maintaining a high standard of usefulness among the members of the profession.

That the Members of the Institute do not and cannot under its Bye-Laws and Constitution derive any pecuniary benefit from their membership.

And Whereas by the said Petition the Petitioners on behalf of themselves and the other Members of the said Institute of Actuaries most humbly prayed that We would be graciously pleased to grant Our Royal Charter for incorporating the Petitioners and others under the title of The Institute of Actuaries or such other title as to Us might seem fit and with all such powers and privileges as to Us might seem fit.

And Whereas the following persons namely:—Charles Ansell, Griffith Davies, Edward Docker, Harold Engelbach, Richard Charles Fisher, John Goddard, Frederick Hendriks, John Adams Higham, Samuel Ingall, Charles MacCabe, John George Priestley, John Ware Stephenson, Charles Stevens, William Henry Tyndall, Thomas Boorman Winser, being Members of a collective body established in the year 1848 under the name of the Actuaries' Club and exercising the calling or profession of Actuary, are desirous of becoming entitled to such privileges as may arise from the incorporation of the Members of the Institute of Actuaries under our Royal Charter.

NOW THEREFORE We having taken the said Petition into Our Royal consideration in Our Council and being satisfied that the intentions of the Petitioners are laudable and deserving of encouragement have constituted erected and incorporated and We by Our Prerogative Royal and of Our especial Grace certain knowledge and mere motion by these Presents for Us and Our Royal Successors do constitute erect and incorporate into one body politic and corporate by the name of The Institute of Actuaries the said Thomas Bond Sprague, Marcus Nathan Adler, George William Berridge, Charles John Bunyon, and Ralph Price Hardy and such other persons as are by this Our Charter made or declared to be members or shall hereafter be admitted as members of that body corporate with perpetual succession and a common seal and with power to alter and renew the same at discretion and with capacity by that name to sue and be sued and to take and hold any personal property and notwithstanding the statutes of mortmain from time to time to purchase acquire take and hold in perpetuity or for any term or estate messuages lands and hereditaments not exceeding the annual value of three thousand pounds such value to be ascertained at the date the said messuages lands and hereditaments are taken by the Institute with power from time to time to sell grant lease exchange mortgage and dispose of the same but so that the body corporate aforesaid shall apply its profits (if any) or other income in promoting its objects and shall not at any time pay any dividend to its members or any of them.

And We do will ordain and declare as follows (that is to say):

Preliminary.

1. In this Our Charter—

The Institute of 1848 means the said Institute of Actuaries established in London in 1848.

Members of the Actuaries' Club means the persons hereinbefore mentioned by their respective names as being Members at the date of this Our Charter of the said Actuaries' Club.

The Institute means the Institute of Actuaries incorporated by this Our Charter.

The Council means the Council for the time being of the Institute.

General Meeting means a General Meeting of the Members of the Institute.

Bye-laws means Bye-laws of the Institute made under this Our Charter.

Commencement of the Bye-laws means the time when the first Bye-laws made under this our Charter come into operation.

Month means calendar month.

The Council.

2. There shall be a Council of the Institute chosen from Fellows of the Institute.

3. The first Members of the Council shall be the following (namely) :—

MARCUS NATHAN ADLER, M.A.
ARTHUR HUTCHESON BAILEY.
GEORGE WILLIAM BERRIDGE.
THOMAS GILLESPIE CHAPMAN BROWNE.
CHARLES JOHN BUNYON, M.A.
JAMES CHISHOLM.
GEORGE STEPHEN CRISFORD.
ARCHIBALD DAY.
ALEXANDER JOHN FINLAISON.
JOHN RALPH GRIMES.
MAJOR-GENERAL JOHN CAULFIELD HANNYNGTON.
RALPH PRICE HARDY.
WILLIAM HUGHES.
GEORGE HUMPHREYS, M.A.
GEORGE KING.
HENRY WILLIAM MANLY.
THOMAS MARR.
JAMES MEIKLE.
EDWARD ALGERNON NEWTON, M.A.
ARTHUR PEARSON.
HENRY WILLIAM PORTER, B.A.
ARTHUR SMITHER.
JAMES SORLEY.
THOMAS BOND SPRAGUE, M.A.

WILLIAM SUTTON, M.A.
ANDREW HUGH TURNBULL.
JAMES VALENTINE.
JOHN WHITCHER.
JOHN HILL WILLIAMS, AND
THOMAS EMLEY YOUNG, B.A.

4. The first meeting of the Council shall be held at Adelphi Terrace in the City of Westminster at Five o'clock in the afternoon on the second Tuesday after the date of this Our Charter.

5. The first Members of the Council shall hold office until Members of the Council are elected under Bye-laws.

6. Bye-laws shall prescribe the number of Members of the Council and the mode of nomination of Candidates for election to the Council and the mode and times of and any other matters relating to the elections including the first election and the mode of filling casual vacancies in the Council.

7. Bye-laws shall regulate the meetings of the Council and prescribe the number of Members of the Council required to be present and acting thereat and regulate the proceedings thereat and the adjournment thereof and the appointment of Committees and any other matters connected with the exercise and discharge of the powers and duties of the Council.

8. No act or proceeding of the Council shall be invalidated by any vacancy in the Council provided the number of Members of the Council be not reduced below one-half of the full number prescribed by Bye-laws.

9. The Council shall have the management and superintendence of the affairs of the Institute including the Examinations hereinafter mentioned and the appointment removal and remuneration (if any) of the Examiners in connection therewith and shall appoint and may remove and shall determine the duties salaries and remuneration of the Secretary Solicitors Bankers Clerks Agents and other officers and servants of the Institute and shall determine the securities if any to be taken from any of them and may make such arrangements and enter into such agreements with them as the Council think fit.

10. The Council may apply the funds of the Institute in acquiring extending and improving a Library for the Institute and in the acquisition renting or erection and fitting up of a Hall and other suitable buildings for the use of the Members of the Institute and for other purposes connected with the profession of Actuaries and in the purchase or renting of a site or sites for a Library Hall and other suitable buildings as aforesaid and in paying the salaries of librarians custodians and other officers and servants for any purposes of the Institute and in otherwise promoting the objects of the Institute.

11. The Council may at meetings at which (subject to any provision in Bye-laws) five Members at least of the Council are present and acting exercise all powers of the Institute except as regards such matters as are by this Our Charter or by Bye-laws required to be transacted by or at a General Meeting.

12. The exercise of all powers for the time being vested in the Council shall be subject to the control of General Meetings but so

that the validity of anything done before any resolution of a General Meeting shall not be affected by any such resolution.

13. Subject to the express provisions of this Our Charter until the commencement of the Bye-laws the affairs of the Institute and the meetings and proceedings of the Institute and of the Council shall be managed conducted and regulated according to and by the Bye-laws and Regulations of the Institute of 1848 as if that Institute and the Council thereof were the Institute and the Council thereof.

President and Vice-Presidents.

14. There shall be a President and Vice-Presidents of the Institute and of the Council whose respective powers duties and privileges (if any) shall be prescribed by Bye-laws.

15. The first President shall be Thomas Bond Sprague. The first Vice-Presidents shall be Marcus Nathan Adler, George William Berridge, George Humphreys and Arthur Pearson.

16. A vacancy in the office of the first President or of any of the first Vice-Presidents shall be filled by the Council.

17. The first President and Vice-Presidents or their respective successors as aforesaid shall hold office until a President and Vice-Presidents respectively are elected or appointed under Bye-laws.

18. The President and every Vice-President shall always be elected or appointed from among the Fellows.

Classes of Members.

19. The Members of the Institute shall be of five classes (namely)—

(1) Fellows.
(2) Associates.
(3) Students.
(4) Honorary Members.
(5) Corresponding Members.

Fellows.

20. All persons who at the date of this Our Charter are attached to the Institute of 1848 as Fellows thereof and also the Members of the Actuaries' Club shall under and by virtue of this Our Charter become and be Fellows of the Institute.

21. During the first five years from the date of this our Charter there shall be eligible as Fellows persons of such qualifications and on such conditions as Bye-laws prescribe.

22. After the end of five years from the date of this Our Charter every person who from time to time desires to become a Fellow shall whether he is an Associate or not be required to pass such Examination or Examinations as the Council prescribes as well as to comply with such conditions (if any) as Bye-laws prescribe subject nevertheless to the said Examination or Examinations being exceptionally dispensed with by the Council if it think fit in such cases on such conditions and in such manner as Bye-laws prescribe.

Associates.

23. All persons who at the date of this Our Charter are Associates of the Institute of 1848 shall under and by virtue of this Our Charter become and be Associates of the Institute.

24. During the first three years from the date of this Our Charter there shall be eligible as Associates persons of such qualifications and on such conditions as Bye-laws prescribe.

25. After the end of three years from the date of this our Charter every person who from time to time desires to become an Associate shall be required to pass such Examination or Examinations as the Council prescribes as well as to comply with such conditions (if any) as Bye-laws prescribe subject nevertheless to the said Examination or Examinations being exceptionally dispensed with by the Council if it think fit in such cases and on such conditions in such manner as Bye-laws prescribe.

Students.

26. After the date of this Our Charter there shall be eligible as Students persons of such qualifications and on such conditions as Bye-laws prescribe.

Honorary Members.

27. All persons who at the date of this Our Charter are Honorary Members of the Institute of 1848 shall under and by virtue of this Our Charter become and be Honorary Members of the Institute subject to such conditions as Bye-laws prescribe.

28. Every other person from time to time who by reason either of his position or of his eminence in science and his experience in matters relating to the profession of an Actuary appears to the Council to be able to render assistance in promoting the objects of the Institute and who is not professionally engaged in practice as an Actuary shall be eligible as an Honorary Member on such conditions as Bye-laws prescribe.

Corresponding Members.

29. All persons who at the date of this Our Charter are Corresponding Members of the Institute of 1848 shall under and by virtue of this Our Charter become and be Corresponding Members of the Institute subject to such conditions as Bye-laws prescribe.

30. Every other person from time to time who is resident out of the United Kingdom and who is professionally engaged in practice as an Actuary and appears to the Council to be able to render assistance in promoting the objects of the Institute shall be eligible as a Corresponding Member on such conditions as Bye-laws prescribe but shall cease to be a Corresponding Member on it being shown to the satisfaction of the Council that he is no longer resident out of the United Kingdom.

Examinations.

31. Examinations required by or under this Our Charter shall be held and passed at such times in such manner and subject to such conditions as the Council prescribes.

Age.

32. Notwithstanding anything in this Our Charter no person who has not attained the age of twenty-one years shall become by virtue of this Our Charter or be at any time eligible as a Fellow.

Decision of Council on Qualifications.

33. The Council shall have power to decide conclusively respecting each person proposed for admission as a Fellow Associate Student Honorary Member or Corresponding Member whether he has or has not fulfilled such conditions as are required by this Our Charter or are prescribed by Bye-laws.

Subscriptions.

34. Notwithstanding anything in this Our Charter no person shall by virtue thereof become or be or be entitled to become or be a Member (other than an Honorary Member or Corresponding Member) of the Institute before the commencement of the Bye-laws unless and until he pays the sum or sums payable by him under the Bye-laws and Regulations of the Institute of 1848. Members who have prior to the date of this Our Charter compounded for the sum or sums payable by them to the Institute of 1848 and Members of the Actuaries' Club always being excepted.

35. Bye-laws shall prescribe the amount of subscription fees or other charges respectively payable from time to time by Fellows Associates and Students other than those Fellows and Associates who have prior to the date of this our Charter compounded for the sum or sums payable by them to the Institute of 1848 and Members of the Actuaries' Club.

Rights of Members.

36. A Fellow may use after his name the initials F.I.A. and an Associate may use after his name the initials A.I.A.

37. All Fellows of the Institute shall subject to any restrictions in Bye-laws be entitled to be present and vote at General Meetings and take part in the discussion of business thereat.

38. All Associates of the Institute shall subject to any restrictions in Bye-laws be entitled to be present and vote at General Meetings and take part in the discussion of business thereat provided nevertheless that Associates shall not be entitled to vote in the election exclusion or suspension of Fellows as prescribed by Bye-laws.

39. All students of the Institute shall subject to any restrictions in Bye-laws be entitled to be present at General Meetings and take part in the discussion of business thereat provided nevertheless that Students shall not be entitled to vote except in such matters as Bye-laws prescribe.

40. Honorary Members and Corresponding Members shall subject to any restrictions in Bye-laws be entitled to be present at General Meetings and take part in the discussion of business thereat but shall not be entitled to vote.

Cesser of Membership.

41. If any person ceases from any cause whatever to be a Member of the Institute he shall not nor shall his representatives have any interest in or claim against the funds or property of the Institute.

Bye-Laws.

42. The Institute from time to time may by a resolution of a General Meeting confirmed at a subsequent General Meeting held not less than seven and not more than twenty-eight days after the former meeting make such Bye-laws as to the Institute seem fit and rescind any Bye-laws and make others in their stead but so that the Bye-laws for the time being be not in any respect repugnant to the law of England or inconsistent with any express provision of this Our Charter.

43. The Council shall within ten months from the date of this Our Charter prepare draft Bye-laws and shall send to each Member of the Institute a printed copy thereof inviting him to offer observations thereon within a time to be limited by the Council and the Council shall take into consideration all observations so offered and shall finally settle the draft Bye-laws and shall send to each Member of the Institute the draft Bye-laws as so finally settled and shall call a General Meeting for the consideration and adoption of Bye-laws to be held on a day not less than one month and not more than three months after the expiration of twelve months from the date of this Our Charter and not less than fourteen days' notice of the time and place of meeting shall be given to the Members of the Institute by the Council and the meeting so called shall be the first General Meeting for the purposes of this Our Charter and all other purposes and the Chairman of that Meeting shall be the President of the Institute or in his absence one of the Vice-Presidents of the Institute or in the absence of all the Vice-Presidents a Member of the Council chosen by the Meeting or in the absence of all the Members of the Council a Fellow of the Institute chosen by the meeting but any want of or irregularity in the sending of any such draft Bye-laws or in the giving of any such notice shall not affect the validity of the Bye-laws.

44. The purposes for which the Institute may in manner aforesaid from time to time make Bye-laws in addition to any purpose in any other provision of this Our Charter indicated include the following (namely):

For regulating the election and admission of the several classes of Members of the Institute;

For regulating the amount and times of payment of entrance fees and other fees and subscriptions or other sums to be paid by Fellows Associates and Students;

For regulating the mode time and place of summoning and holding annual and other General meetings and special meetings of the Institute and the mode of voting thereat whether in person or by proxy or by ballot or by voting papers or otherwise and the conduct of proceedings thereat:

For defining and regulating the privileges and benefits of the several classes of Members of the Institute;

For prescribing the cases circumstances conditions and manner in and on which a Member of the Institute may be excluded or suspended from membership;

For regulating the appointment of Trustees and their powers and duties and the disposal of the moneys and property of the Institute;

For regulating the appointment election rotation and retirement of a Treasurer or Treasurers Honorary Secretary or Secretaries and of an Auditor or Auditors;

And generally such Bye-laws as from time to time seem to the Institute requisite for the better execution of this Our Charter and the furtherance of the objects of the Institute.

45. Bye-laws made by the Institute shall not commence or have effect until they have been submitted to and allowed by the Lords of Our Council.

46. The Council of the Institute shall cause all Bye-laws when so allowed to be printed with the form of allowance and to be published with that form in the London Gazette and the Edinburgh Gazette and the Dublin Gazette.

In Witness whereof we have caused these Our Letters to be made Patent.

Witness Ourself at Westminster the twenty-ninth day of July in the forty-eighth year of Our Reign.

By Warrant under the Queen's Sign Manual.

PALMER.

L. S.

On the Graduation of Mortality Tables. By John Adams Higham, *Fellow of the Institute of Actuaries.*

Mr. SPRAGUE, in his report on Mr. Finlaison's Tables of Mortality among Government Life Annuitants, states as the result of his study of the subject of graduation that the most satisfactory system of adjustment is the graphic method; and he supports this opinion by referring to the irregularities which he regards as a consequence of the use of Mr. Woolhouse's method of adjustment. I do not doubt that Mr. Sprague would conceive and correctly draw a curve to satisfy all the conditions of good graduation;

but in my own hands the graphic method would be a failure, and there may be others who doubt if they have skill to draw the curve and patience to amend it by the successive trials which Mr. Sprague himself finds necessary.

For the benefit of such I would point out that the irregularity may be reduced to insignificant proportions by the use of a more effective formula, given in the *Journal*, vol. xxiv, p. 46, where the adjusted value is

$$\frac{64\Sigma}{10{,}000} - \frac{4S}{300},$$

Σ being the result of summing the terms of a series involving third differences, five at a time, four times, and S being the result of summing five at a time twice, and then, nine at a time.

Applied to one of Mr. Finlaison's Tables of Female Annuitants, this formula gives, as presently shown, a column of which the second differences present a wavy line in place of a zig-zag. Improved smoothness is not obtained at the expense of adherence to fact, for it will be seen in the columns headed "departure" that the more even graduation is also the nearer to the unadjusted values.

It is one thing to smooth the road over a hill and across a valley, and another thing to adapt the road to our convenience by cutting and embankment. Graduation is road-making; adjustment is too often engineering.

When graduation has produced a wavy line of differences, the question arises whether the undulations ought to be there. I apprehend that at this point an attachment to the graphic method may mislead; and that having a preconceived idea of the curve as it ought to be, or as we would wish it to be, we may remove indications which should be retained of some special or climacteric conditions affecting the class of persons under observation. It would seem for instance a mistake to obliterate from the table under consideration the wave which represents an accelerated increase in the rate of mortality at about the age of fifty, and a slackened rate of increase for some time afterwards.

Whatever be the final adjustment adopted by an actuary, I think that, as a means of tracing and testing what has been done, he should always furnish an arithmetical graduation, which is mechanical in its attendance on fact and so simple that a junior clerk can perform the work. Thus only can we distinctly read the story which the observed facts really have to tell. For example, the arithmetical graduation given in the succeeding page shows a

diminishing mortality from age 42 to age 47. It is interesting to have a circumstance of this kind clearly brought into view, but in saying so I do not question the soundness of the judgment with which Mr. Finlaison has ignored an anomaly arising possibly from the insufficiency of the number of persons under observation.

[*See* pp. 19–21.]

Construction of the Formula.

If a series of numbers increasing by third differences be summed p at a time, the results summed q at a time, these results again r at a time, and so on until all be collected into one term; then will the final result, S, be equal to

$$M\left\{U_0+\frac{A-n}{2}\Delta_1+\left(\frac{\overline{A-n}.\overline{A-(n+2)}}{2.4}+\frac{B-n}{2.3.4}\right)\Delta_2\right.$$
$$\left.+\left(\frac{\overline{A-n}.\overline{A-(n+2)}.\overline{A-(n+4)}}{2.4.6}+\frac{\overline{B-n}.\overline{A-(n+2)}}{2.3.4.2}\right)\Delta_3\right\}$$

where M represents the product of $p\times q\times r\times\ldots$ &c.,
A „ the sum of $p+q+r+\ldots$ &c.,
B „ the sum of their squares,
and n „ the number of the summations which have been made.

The number of terms in the original series which have entered into summation is $A-(n-1)$; and for purposes of graduation this is taken as an odd number.

The central term U_c is $U_{\frac{A-n}{2}}$ and it is equal to

$$U_0+\frac{A-n}{2}\Delta_1+\frac{\overline{A-n}.\overline{A-(n+2)}}{2.4}\Delta_2+\frac{\overline{A-n}.\overline{A-(n+2)}.\overline{A-(n+4)}}{2.4.6}\Delta_3$$

Therefore, differencing,

$$\frac{S}{M}-U_c=\frac{B-n}{2.3.4}\cdot\Delta_2+\frac{\overline{B-n}.\overline{A-(n+2)}}{2.3.4.2}\Delta_3$$

$$U_c=\frac{S}{M}-\frac{B-n}{2.3.4}\left\{\Delta_2+\frac{\overline{A-(n+2)}}{2}\cdot\Delta_3\right\}$$

$\frac{A-(n+2)}{2}$ will be found a constant, whatever the number of summations of different scope required for reducing to a single term the same number of original terms. Consequently we have but two unknown quantities, U_c and the expression involving Δ_2

and Δ_3; and any two completed summations, furnishing two equations, are sufficient for solution.

Example, let the numbers have been summed in fives, four times in succession.

$$M=5\times5\times5\times5=625$$
$$A=5+5+5+5=20$$
$$B=5^2+5^2+5^2+5^2=100$$
$$n=4$$
$$U_c=\frac{S}{625}-\frac{96}{24}(\Delta_2+7\Delta_3)=\frac{S}{625}-4(\Delta_2+7\Delta_3)$$

Again, let the numbers have been summed in fives, twice; and then in nines.

$$M=225;\quad A=19;\quad B=131;\quad n=3;$$
$$U_c=\frac{S}{225}-\frac{16}{3}(\Delta_2+7\Delta_3)$$

whence $$\frac{3U_c}{4}=\frac{S}{300}-4(\Delta_2+7\Delta_3).$$

Bring down the former equation, and for distinction write Σ instead of S—

$$U_c=\frac{\Sigma}{625}-4(\Delta_2+7\Delta_3);$$

differencing, $$\frac{U_c}{4}=\frac{\Sigma}{625}-\frac{S}{300}$$
$$U_c=\frac{4\Sigma}{625}-\frac{4S}{300}=\frac{64\Sigma}{10{,}000}-\frac{4S}{300}$$

which is the formula employed in the foregoing graduation.

In this manner we can correct to third differences Mr. John Finlaison's method, extended to summations of any number and scope; but the resulting formulas, to be of any value, should contain easy factors for columnar work, and should give preponderance, sufficient yet not excessive, to the central terms of the original series as compared with the outlying terms, on which point I take Mr. Woolhouse's formula as a standard.

The formula already quoted is the best I can offer in regard to smoothness of graduation. I will submit one other as the most easy in working.

Let Σ be the result of summing thrice in fives, then in fours, and lastly in twos.

EXAMPLE OF GRADUATION BY $\frac{64\Sigma}{10,000} - \frac{4S}{300}$.

Government Annuities Act, 1882.—*Female Life Annuitants, four or more Years elapsed from date of Purchase.*

Number of Deaths out of 100,000 *living at each Age.*

Age	Unadjusted Number of Deaths (*Report*, page 24)	First Fives ÷ 10	Second Fives ÷ 100	Third Fives ÷ 100	Fourth Fives ÷ 100 being $\frac{\Sigma}{100}$	$\frac{8\Sigma}{1,000}$	$\frac{64\Sigma}{10,000}$	Second Fives in Nines, being $\frac{S}{100}$	One-third, being $\frac{S}{300}$	Sum of two last, being $\frac{4S}{300}$	$\frac{64\Sigma}{10,000} - \frac{4S}{300}$ Graduated Number
19	0										
20	0										
21	0	0									
22	0	0									
23	0	370	183								
24	0	673	273								
25	3,704	791	385	1,701							
26	3,030	892	435	1,919							
27	1,176	1,123	425	2,014	9,317	7,454	5,963	3,030	1,010	4,040	1,923
28	1,010	875	401	1,929	9,209	7,367	5,894	3,111	1,037	4,148	1,746
29	2,308	572	368	1,754	8,751	7,001	5,601	3,107	1,036	4,143	1,458
30	1,227	544	300	1,593	8,103	6,482	5,186	2,995	998	3,993	1,193
31	0	564	260	1,461	7,521	6,017	4,814	2,841	947	3,788	1,026
32	897	441	264	1,366							
33	1,210	474	269	1,347							
34	1,071	613	273								
35	1,567	596	281								
36	1,389	602									
37	721	530									
38	1,268										
39	350										

Comparison of the proposed Graduation with the Unadjusted Materials, with a Graduation by Mr. Woolhouse's Formula, and with Mr. Finlaison's Adjustment (Gompertz and Woolhouse adapted).

Female Annuitants.—Four years elapsed from Purchase.—Number of Deaths out of 100,000 *living at each Age.*

Age	Δ_2	Δ_1	Graduation by $\frac{64\Sigma}{10,000} - \frac{4S}{300}$	Departure		Unadjusted Number of Deaths	Departure		Graduation by Mr. Woolhouse's Formula	Δ_1	Δ_2	Mr. Finlaison's Adjustment (*Report*, page 27)	Δ_1	Δ_2
				Plus	Minus		Plus	Minus						
27	−111	−177	1,923	747	...	1,176	869	...	2,045	−285	−107			
28	+ 23	−288	1,746	736	...	1,010	750	...	1,760	−392	+225			
29	+ 98	−265	1,458	...	850	2,308	...	940	1,368	−167	+ 46			
30	+105	−167	1,193	...	34	1,227	...	26	1,201	−121	− 53			
31	+ 92	− 62	1,026	1,026	...	0	1,080	...	1,080	−174	+225			
32	+ 48	+ 30	964	67	...	897	9	...	906	+ 51	+118			
33	− 18	+ 78	994	...	216	1,210	...	253	957	+169	−171			
34	− 46	+ 60	1,072	1	...	1,071	55	...	1,126	− 2	+ 24			
35	− 10	+ 14	1,132	...	435	1,567	...	443	1,124	+ 22	− 33			
36	− 1	+ 4	1,146	...	243	1,389	...	243	1,146	− 11	+ 55			
37	+ 13	+ 3	1,150	429	...	721	414	...	1,135	+ 44	− 79			
38	+ 17	+ 16	1,153	...	115	1,268	...	89	1,179	− 35	+111			
39	+ 7	+ 33	1,169	819	...	350	794	...	1,144	+ 76	− 73			
40	− 18	+ 40	1,202	...	789	1,991	...	771	1,220	+ 3	+ 57	1,082	+ 22	+ 1
41	− 26	+ 22	1,242	14	...	1,228	...	5	1,223	+ 60	− 98	1,104	+ 23	0
42	− 35	− 4	1,264	...	177	1,441	...	158	1,283	− 38	+ 38	1,127	+ 23	0
43	− 15	− 39	1,260	304	...	956	289	...	1,245	0	− 93	1,150	+ 23	+ 1
44	+ 2	− 54	1,221	127	...	1,094	151	...	1,245	− 93	+ 53	1,173	+ 24	0

45	+ 25	− 52	1,167	...	191	1,358	...	206	1,152	− 40	+ 22	1,197	+ 24	+ 1
46	+ 35	− 27	1,115	...	368	1,483	...	371	1,112	− 18	+ 26	1,221	+ 25	0
47	+ 53	+ 8	1,088	264	...	824	270	...	1,094	+ 8	+ 27	1,246	+ 25	+ 1
48	+ 43	+ 61	1,096	301	...	795	307	...	1,102	+ 35	+ 92	1,271	+ 26	0
49	+ 28	+104	1,157	...	171	1,328	...	191	1,137	+127	+ 19	1,297	+ 26	+ 58
50	− 6	+132	1,261	242	...	1,019	245	...	1,264	+146	− 44	1,323	+ 84	+ 18
51	− 11	+126	1,393	...	157	1,550	...	140	1,410	+102	+ 10	1,407	+102	+ 14
52	− 20	+115	1,519	...	92	1,611	...	99	1,512	+112	+ 8	1,509	+116	+ 5
53	− 21	+ 95	1,634	...	119	1,753	...	129	1,624	+120	− 52	1,625	+121	− 54
54	− 7	+ 74	1,729	...	43	1,772	...	28	1,744	+ 68	− 28	1,746	+ 67	− 26
55	+ 6	+ 67	1,803	255	...	1,548	264	...	1,812	+ 40	+ 49	1,813	+ 41	+ 47
56	+ 3	+ 73	1,870	...	152	2,022	...	170	1,852	+ 89	+ 10	1,854	+ 88	+ 12
57	+ 6	+ 76	1,943	20	...	1,923	18	...	1,941	+ 99	− 51	1,942	+100	− 50
58	+ 11	+ 82	2,019	177	...	1,842	198	...	2,040	+ 48	+ 49	2,042	+ 50	+ 48
59	+ 27	+ 93	2,101	...	228	2,329	...	241	2,088	+ 97	+ 43	2,092	+ 98	+ 44
60	+ 40	+120	2,194	...	251	2,445	...	260	2,185	+140	+ 10	2,190	+142	+ 4
61	+ 41	+160	2,314	393	...	1,921	404	...	2,325	+150	+ 39	2,332	+146	+ 37
62	+ 46	+201	2,474	29	...	2,445	30	...	2,475	+189	+ 68	2,478	+183	+ 75
63	+ 28	+247	2,675	...	17	2,692	...	28	2,664	+257	+ 25	2,661	+258	+ 21
64	− 1	+275	2,922	38	...	2,884	37	...	2,921	+282	− 7	2,919	+279	+ 1
65	− 3	+274	3,197	...	198	3,395	...	192	3,203	+275	− 11	3,198	+280	− 6
66	− 2	+271	3,471	241	...	3,230	248	...	3,478	+264	+ 3	3,478	+274	+ 4
67	+ 26	+269	3,742	...	191	3,933	...	191	3,742	+267	+ 38	3,752	+278	+ 32
68	+ 63	+295	4,011	...	295	4,306	...	297	4,009	+305	+ 37	4,030	+310	+ 24
69	...	+358	4,306	177	...	4,129	185	...	4,314	+342	...	4,340	+334	
70	...	...	4,664	...	66	4,730	...	74	4,656	...	...	4,674		
				6,407	5,398	...	6,617	5,545						

$$M=1000\,;\quad A=21\,;\quad B=95\,;\quad n=5\,;$$

$$U_c=\frac{\Sigma}{1000}-\frac{15}{4}\{\Delta_2+7\Delta_3\}.$$

And let S be the result of summing in fives, four times.

$$U_c=\frac{S}{625}-4\{\Delta_2+7\Delta_3\}\quad\text{(as before)}$$

$$\frac{15U_c}{16}=\frac{15S}{16\times625}-\frac{15}{4}\{\Delta_2+7\Delta_3\}$$

differencing, $$U_c=\frac{16\Sigma}{1000}-\frac{15S}{625}=\frac{2\Sigma-3S}{125}.$$

The central term U_8 is equal to

$$\begin{aligned}&-\cdot008u_0-\cdot016u_1-\cdot016u_2+\cdot024u_4+\cdot080u_5+\cdot144u_6\\&+\cdot192u_7+\cdot200u_8+\cdot192u_9+\cdot144u_{10}+\cdot080u_{11}\\&+\cdot024u_{12}-\cdot016u_{14}-\cdot016u_{15}-\cdot008u_{16}\end{aligned}$$

(See the *Journal*, vol. xxiv, p. 45, for the method of throwing the formula into this form.)

This bears considerable resemblance, as was desired, to Mr. Woolhouse's formula, wherein the central term U_7 is equal to

$$\begin{aligned}&-\cdot024u_0-\cdot016u_1+\cdot024u_3+\cdot056u_4+\cdot168u_5+\cdot192u_6+\cdot200u_7\\&+\cdot192u_8+\cdot168u_9+\cdot056u_{10}+\cdot024u_{11}-\cdot016u_{13}-\cdot024u_{14}\end{aligned}$$

It avoids, however, the weak point of Mr. Woolhouse's formula, which is the sudden rise in the coefficient of u_5 and the corresponding sudden fall in the coefficient of u_{10}. Mr. Woolhouse's curve is, so to speak, high-shouldered; and this was the occasion of the most material of the amendments which he found it necessary to make by inspection after graduating the H^M Table. An excess in the unadjusted decrement at age 74, insufficiently apportioned among the second and third terms on either side, introduced irregularities requiring him to transfer twelve deaths from age 70 to age 69; six from age 72 to age 71; and ten from age 76 to age 77.

Subjoined is a graduation of this portion of the H^M Table by the easy formula last given, and a comparison of the results with those of Mr. Woolhouse. The uncorrected outcome of Mr. Woolhouse's graduation is taken from Mr. Ackland's paper in the *Journal*, vol. xxiii, page 355.

Graduation in Simplest Form.

The graduated central value is $=\dfrac{2\Sigma-3S}{125}$.

In conjunction with three summations, five at a time, common to both expressions, a fourth summation in fives gives S; as

against two summations, in fours and twos respectively, which give Σ.

If a, b, &c., be the terms after three summations in fives,

$$S = a + b + c + d + e$$
$$\Sigma = (a + b + c + d) + (b + c + d + e)$$
$$3S = 3(a + b + c + d + e)$$
$$2\Sigma = 2a + 4(b + c + d) + 2e$$
$$2\Sigma - 3S = (b + c + d) - (a + e),$$

being the sum of the three central terms of the five to be dealt with, less the two outside terms.

This contraction saves three columns, and it may be introduced at any stage of the work; the earlier it can be done, the greater the economy of figures. In the following example it is introduced at outset; but if the ungraduated values in a series be very irregular, it is advisable to do it later, in order to avoid trouble from negative quantities in differencing.

Age	HM Ungraduated Decrement to Radix 10,000	Summation of Fives			Second Fives	Third Fives	Fourth Fives ÷ 10 being $\frac{2\Sigma - 3S}{10}$	$\frac{2\Sigma - 3S}{12{\cdot}5}$ Graduated Decrement to Radix 100,000 (last col. ×·8)
		Three Central Terms	Two Outside Terms	Three less Two				
60	184							
61	186							
62	191	577	390	187				
63	200	597	401	196				
64	206	621	411	210	1,026			
65	215	641	420	221	1,055			
66	220	655	443	212	1,129	5,511		
67	220	677	461	216	1,173	5,615		
68	237	703	433	270	1,128	5,694	2,843	2,274
69	246	696	442	254	1,130	5,777	2,900	2,320
70	213	681	505	176	1,134	5,833	2,967	2,374
71	222	703	489	214	1,212	6,077	3,049	2,439
72	268	733	513	220	1,229	6,289	3,125	2,500
73	243	811	463	348	1,372	6,512	3,191	2,553
74	300	784	513	271	1,342	6,537	3,205	2,564
75	241	786	467	319	1,357	6,500	3,169	2,535
76	245	710	526	184	1,237	6,208	3,080	2,464
77	224	695	460	235	1,192	5,931	2,963	2,370
78	226	669	441	228	1,080	5,625		
79	219	641	415	226	1,065	5,367		
80	196	606	399	207	1,051			
81	191	560	391	169	979			
82	173	536	315	221				
83	172	464	308	156				
84	119							
85	117							

Comparison.

Age	The foregoing Graduation	Δ_1	Δ_2	Woolhouse untouched	His Amendment by Inspection	Woolhouse amended	Δ_1	Δ_2
68	2,274	+46	+ 8	2,274	...	2,274	+45	+ 7
69	2,320	+54	+11	2,307	+12	2,319	+52	+10
70	2,374	+65	− 4	2,383	−12	2,371	+62	+ 2
71	2,439	+61	− 8	2,427	+ 6	2,433	+64	− 7
72	2,500	+53	−42	2,503	− 6	2,497	+57	−33
73	2,553	+11	−40	2,554	...	2,554	+24	−75
74	2,564	−29	−42	2,578	...	2,578	−51	−12
75	2,535	−71	−23	2,527	...	2,527	−63	−27
76	2,464	−94	...	2,474	−10	2,464	−90	
77	2,370	...	...	2,364	+10	2,374		

It will be seen that the results resemble those of Mr. Woolhouse, but are a little more even; and that his amendments by inspection are virtually brought out in the first operation.

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*Notes on Friendly-Society Legislation.**

[The following contribution was prepared for the *Journal* more than two years ago. It deals with a subject of extreme importance, and one to which, from time to time, we purpose making such reference as may be deemed desirable.—Ed. *J.I.A.*]

More than nine years have now elapsed since the Friendly Societies' Act of 1875 came into operation, and the present may not be regarded as an unsuitable moment to pass in review the events and occurrences relating to the subject in hand that have marked this interval, and to investigate the general effect of so maturely considered a statute upon friendly societies. Rarely has so much public interest been manifested in any effort of domestic legislation, as was evinced in the heavy task Parliament—or more particularly, a few prominent members upon whom the burden of the enquiry rested—set itself, in undertaking to remedy the then existing laws affecting friendly societies, and to remove the defects and confusion of previous statutory enactments. That the matter was considered one of urgent importance is obvious from

* *The Friendly Societies' Act*, 1875.

The Reports of the Chief Registrar of Friendly Societies, for the years 1875 to 1882 inclusive.

The Friendly Societies' (Quinquennial Returns) Act, 1882.

the circumstance that it was pressed forward successively by both parties of the State, and that the Royal Commission sat, at intervals, for five years, during which period, as will readily be understood, the Commissioners received a mass of evidence bearing upon almost every conceivable point in connection with the position and operations of friendly societies. It would be impossible to over-estimate the difficulty the Commissioners must have experienced in sifting the vast amount of information thus obtained, from witnesses interested and disinterested, and in apportioning the proper weight to conflicting testimony; and it can occasion little surprise that their report was not considered satisfactory on all hands. Before proceeding, with the aid of the annual reports of the Chief Registrar, to trace the working of the Act, it may be advantageous to refer to one or two considerations arising out of their report. It appears, then, that the Commissioners attributed the insolvency, which so largely existed, to the want of knowledge on the part of the promoters and officials of friendly societies, rather than to wilful mismanagement or fraud; and they seem to have been unanimously of opinion that the existing tables of sickness and mortality applicable for valuation and other purposes were totally inadequate, regard being given, among others, to the facts that there were frequently special societies for specific trades—in which the exposure to death and accident varied between very wide limits; and that the rates of death and sickness differed greatly according to locality. While deprecating the idea that societies should not be registered unless their rates of contribution for sickness and burial benefits had been certified by an actuary, the Commissioners thought that there might be two classes of certificates of registration: for example, societies merely complying with the letter of the law to be registered under one class, and those giving evidence that they were established on a solvent basis to be registered under the other class. It was further suggested that the latter certificates should be of a temporary nature only, holding good merely from valuation to valuation. In addition to these points, the question was also raised as to whether power should be given to the Registrar to readjust the contracts of societies appearing from their actuarial reports to be in an insolvent condition.

Upon some of the foregoing conditions it may not be improper to offer a few remarks. A highly interesting discussion on the salient features of the Commissioners' Report took place at the Institute of Actuaries on 4 January 1875 (of which we append an abstract from the pages of the *Insurance Record*). A consideration

of this debate will show that there existed a wide divergence of views, in many respects, among the able and experienced men who took part therein. A concensus of opinion seems to have prevailed that the available data were inadequate and untrustworthy; and nobody will be found at the present time to deny that the statistics of sickness at the higher ages are altogether insufficient in number and extent for practical purposes. Illustrations of the difficulty and obstacles in the way of adopting special tables for special trades and localities were given by Mr. Neison, who, for instance, remarked that although a society might be started with the object of enlisting the support solely of members of a certain trade, it was frequently found that but a small proportion of the whole body were engaged in such a trade.

The brunt of the discussion, however, centred upon the question of registration, and numerous points of varying importance were mooted; for example, whether registration should be voluntary or compulsory; whether there should be two classes of registration (as already referred to) or only one; whether the certificates of registration should be of temporary or permanent effect; whether societies comprising only a small number of members should be admitted to registration; and whether societies seeking registration should deposit a certain amount with the Commissioners of the National Debt until their funds, or their incomes, had reached a certain amount. To these various suggestions we shall not, at this stage of our enquiry, refer in detail, although hereafter we may have some observations to make regarding them. A point of prominent interest, which, however, should not be similarly passed by, was strikingly brought out. To those conversant with the practice of friendly societies, Mr. Pattison's statement that three out of every four cases of insolvency were occasioned by the inadequacy of the rates of contribution will cause little surprise; but the hopes of politicians who were striving to secure the solvency of the societies must have been rudely shattered by the conviction expressed by Mr. Pattison, Mr. Hodge, and others, that it would be futile to start societies with adequate rates of contribution in the face of the competition of insolvent societies who were charging insufficient premiums. The same view of the matter, virtually, was taken by Mr. Adler, who referred to the important question of the reduction of contracts in cases of insolvency, and based his objection to the Chief Registrar having the power to effect such reduction on the ground that it would lead to a heavy secession of recent members. Mr. Adler also called

attention to the fact that a power to reduce contracts in the cases of life assurance companies was contained in the Act of 1870, and had not been taken advantage of. Now, however, that the experiment of readjusting the contracts has been successfully tested with the Great Britain Mutual Life Assurance Society, the matter may be worthy of reconsideration. The foregoing are but a few of the difficulties arising out of a subject which may be said to abound in controversial points.

Among the more important alterations in the law introduced by the Act of 1875, were the following:

An Actuary to be attached to the Central Office;
Every registered society to send in an actuarial valuation quinquennially;
Annual accounts to be examined by an auditor;
Treasurer bound to give security;
Agents to be liable to criminal prosecution for withholding moneys;
No membership to be forfeited by omission to pay the contribution until due notice had been given;
The privilege of nomination to death benefits extended to other than blood relations;
Additional exemption from certain stamp duties granted;
Branches of societies (previously registered as societies) could be re-registered as branches;
No society to be registered under the same name as any existing registered society;
No collector or agent to be a director or committeeman;
Facilities given for loans to members on personal security;
And power given to the Chief Registrar to suspend registry in the cases of societies not complying with the law.

Among the foregoing modifications, the insistence of quinquennial valuations from all registered societies (excepting only in such cases as the Registrar, with the authority of the Treasury, may dispense with them) is of primary significance. The permission given to the Chief Registrar to secure the services of an actuary is also an improvement of the greatest value, and its beneficial effect is to be perceived in the Report of the Chief Registrar for 1876—the first issued subsequent to the appointment of Mr. Sutton as Actuary to the Registry—which is one of the most suggestive of the series, and is replete with valuable statistics and interesting information. It will be unnecessary to

enlarge upon the remaining alterations, which will probably be acknowledged to be salutary as far as they go. The clauses concerning the power to grant loans to members upon "the written security of themselves and two satisfactory sureties" cannot, however, be favourably regarded. It requires little foresight to discern that, unless the utmost care and precaution be taken, societies adopting these provisions of the Act would run a very serious risk. The times when members will principally desire to avail themselves of their privilege will be times of severe hardship, when the labour market is overstocked and work difficult to obtain, or when a strike has occurred and thrown a large number of operatives upon their last resources. At such a juncture, so far indeed from being more than usually particular with the security offered by the sureties—and personal security alone is open to objection under the most favourable circumstances—it may even happen that, actuated by a desire to assist fellow-members over a period of distress, the managing body will relax their caution. We mention this matter as, although of some consequence, it is very liable to be overlooked. The unwisdom of the provisions referred to were incontrovertibly shown in the valuation of a society that not long since came to light, in which, besides there being a heavy deficiency due, as usual, to the preposterous lowness of the rates of contribution, it was pointed out that a large portion of the assets comprised loans to members on personal security.

The Actuarial Commission, which consisted of Messrs. W. P. Pattison, R. P. Hardy, and A. J. Finlaison, was appointed to advise as to the forms to be issued by the Chief Registrar for the purposes of the various returns, and as to the best available data for valuations, pending the construction of the tables of sickness and mortality from the Government returns; and its proceedings may now be briefly considered. With respect to the forms of return recommended, although it is to be regretted that they should have been of so elaborate and complicated a character, still it is not easy to see how they could be simplified without sacrificing in some degree the objects for which they were primarily imposed. From the Report of the Chief Registrar for 1875 (pages 14 and 15), we notice that he was unable to accept, without modification, the recommendations of the Commissioners, the principal departure being that, in the forms for quinquennial return of sickness and mortality, and for valuation, instead of the members being classified therein according to the years of birth (as advised by the Commissioners), a simple enumeration of the

members individually was required. At the same time it was open to societies mustering over 1,000 members to make their returns in compliance with the Commissioners' recommendations. The modification of the Chief Registrar seems to us to be a wise one. It is not desirable that societies should have anything further to do beyond supplying the raw material; and by confining the requisition to this point, a larger degree of accuracy will be ultimately obtained, and our confidence in the statistical matter greatly strengthened. It is true that the returns were in consequence bulkier, and that greater actual labour was entailed in their preparation; but though this may have pressed heavily upon the officials of friendly societies in the past, the Act of Parliament which received the Royal Assent on 10 August 1882, and by which quinquennial returns of sickness and mortality are no longer deemed necessary, will reduce the work to a large extent. Another recommendation which will be admitted to be both timely and judicious was that societies should introduce provisions into their rules reducing the amount of sick-pay by one-half at the expiration of twelve-months' continuous sickness, and that one-quarter of the full allowance only should be payable in cases of sickness prolonged beyond two years. This would be doubly efficacious, inasmuch as not only would the funds be considerably relieved in cases of constant incapacity from work, but the fraudulent claims also would thereby be reduced. Passing to the recommendation of the Commissioners that the tables of sickness and mortality deduced from the experience, for the years 1866-1870, of the Manchester Unity of Oddfellows in rural, town, and city districts combined, might be temporarily adopted as a basis for the rates of contribution, there will be seen, on consideration, to be many reasons for the selection; and it should not escape attention that in the "Revised Instructions" to public valuers issued by the Treasury in 1880 (see *Report of Chief Registrar for* 1880, page 55, Appendix A), it is stated that in no valuation of a society's future sickness liabilities should the total sickness per annum up to age 70 be assumed to be less, or the rate of mortality at any age be assumed to be greater, than that given by the tables just mentioned. The observations on which these tables were founded, embracing 1,321,006 years of life, and 1,975,032 weeks' sickness, constitute the largest experience ever compiled. The recency of the period to which the data belonged is likewise a favourable point; while the vast extent of the society, the diversity of the trades or

occupations of its members, and the circumstance that its supporters are drawn from all parts of the kingdom, healthy and unhealthy, combine to render the experience well suited for use in cases where an average table is required.

An instructive article from the pen of Mr. A. J. Cooke, on the subject of "Health; or, Sick Benefit Assurance", appearing in the *Insurance Record* for 2 December 1881, compares the expected annual sickness per member according to the several tables most in use. The writer gives the following comparative table, the last column of which, however, we have added, for the sake of completeness:

Table A.—*Showing the expected Annual Sickness per Member, in Weeks, according to the following Tables.*

Age	Highland Society, 1825	Mr. Ansell, 1835	Mr. Neison, Sen., 1836-1840	Mr. Finlaison, 1846-1850	Manchester Unity (Mr. Ratcliffe), 1856-1860	Manchester Unity (Mr. Ratcliffe), 1866-1870	Mr. Neison, "Foresters", 1871-1875	Age
20	...	0·77	0·83	0·98	0·82	0·70	0·82	20
25	0·58	0·80	0·87	0·97	0·81	0·78	0·85	25
30	0·62	0·86	0·91	0·98	0·83	0·86	0·97	30
35	0·67	0·95	0·98	1·02	0·94	1·01	1·15	35
40	0·75	1·11	1·18	1·17	1·14	1·17	1·37	40
45	0·96	1·35	1·49	1·33	1·41	1·48	1·71	45
50	1·36	1·70	1·96	1·64	1·84	1·98	2·27	50
55	1·82	2·25	2·70	1·99	2·61	2·72	3·21	55
60	2·34	3·29	4·16	2·67	4·02	4·03	4·59	60
65	4·40	5·07	7·75	3·90	6·20	6·30	7·97	65
70	10·70	11·79	14·03	6·23	9·87	10·08	12·00	70
75	...	...	21·46	9·54	14·90	15·07	17·66	75
80	...	...	26·94	13·95	19·09	20·71	20·92	80

From the above figures it will be noticed that the Manchester Unity experience, speaking broadly, gives fairly average results. At the higher ages, however, the divergence between the expected weeks' sickness as given by Mr. Neison, Mr. Finlaison, and the Experience of the Manchester Unity is so marked as to confirm the impression, which has existed for a long time past, that our statistics of sickness at the very old ages are inadequate and untrustworthy. It is in this respect that the tables in course of preparation by the Actuary to the Central Office (which we learn from the report for 1881 will embrace perhaps as many as 10,000,000 years of observed life) will prove invaluable. The necessity is here seen for adopting some such expedient as the temporary recommendation of the Actuarial Commissioners that

in computing the contributions to provide for sickness-benefits throughout life, the rates should combine a provision for the sickness allowance up to a certain age (70 or 75, for example), with a provision for a superannuation allowance of a fixed proportion of the sickness allowance. In view of the serious irregularities referred to, it will be acknowledged by all, that a heavy responsibility rests with valuers in selecting a basis for the purpose of valuation. Mr. Cooke adds, in explanation of the discrepancies, "the difference "between the figures of Mr. Neison, Mr. Finlaison, and Mr. "Ratcliffe (that is, the Manchester Unity Experience), partly arises "through the elimination by Mr. Finlaison, of cases of chronic "sickness, and the experience of certain hazardous or unhealthy "occupations, namely, those of sailors, miners and colliers." But if we admit this to satisfactorily account for the remarkable lightness of the expected sickness as given by Mr. Finlaison, it has, manifestly, no bearing upon the divergence of Mr. Neison's results from those of the Manchester Unity Experience, which remains unexplained.

One of the most disappointing features of the Registrar's Reports is the paucity of valuation returns rendered; and although on 31 December 1880 the period of five years expired during which every society registered under the Act of 1875 was required to send in an actuarial valuation of assets and liabilities, the report for 1880 states that only 4,556 societies and branches —a small number when compared with those making the required annual returns—had complied with this obligation, and adds that such "valuation returns generally cannot be spoken of very "favourably either as to the manner in which they are made or as "to the results brought out." A synoptical analysis of the valuation returns sent in would yield precise information respecting a variety of points upon which conjecture, or opinions more or less well-founded, have hitherto predominated; and facts of a highly instructive nature would be disclosed. The subject of valuation, is, however, such a comprehensive one, and opens up so many side-paths which it would be undesirable to leave unexplored, that for the present we defer entering upon its examination, and make but a cursory reference to it. But before proceeding to the consideration of other matters of interest allusion may here appropriately be made to the "Memorandum on Valuations" issued by the Central Office in 1880, in which the outlines of the process of valuations are graphically described in such a way as to render the subject easy of comprehension to the classes from which the

officers of societies are chiefly drawn; and likewise to the especially interesting "Observations by the Actuary" with respect to the following kinds of societies to whom valuation returns may, under ordinary conditions, be deemed inapplicable, namely (1) Dividing Societies, (2) Levying Societies, (3) Societies for the Insurance of Juveniles, (4) Deposit Societies, and (5) Societies having a very small number of members. These memoranda are written in a popular style, and are admirably suited to attain the objects for which they were issued. It is by such means, we think, that the Registry will best be able to cope with the lamentable ignorance of the subject universally admitted to exist among those to whom the knowledge of its principles is of such vital importance.

The effect of the legislation of 1875 seems to have been to check in an appreciable degree the number of societies annually applying for registration. The figures which follow will show, however, that the Act is gaining ground, a steady increase in the number registered being observable in each year with the single exception of 1880, in which the number shows a falling off of 527, and this is attributed by the Registrar (and perhaps not unjustifiably) to the disturbed state of the country owing to the General Election of that year. Notwithstanding this increase the Registrar points out that "it would be idle to overlook the fact that the "greater strictness both of the law and of its administration has "and must have a deterrent effect on societies", and judging from the figures given, which show that the total number of new friendly societies registered in 1872 was more than double that of 1880, his conclusion cannot be gainsaid.

Table B.

Year	No. of New Friendly Societies registered in England and Wales	No. of Dissolutions in England and Wales	No. of Amalgamations in England and Wales	No. of Societies making the Annual Returns in England and Wales	Total Number of Members in such Societies	Total Funds of such Societies
						£
1876	357	76	3	11,282	3,404,187	9,336,948
1877	1,127	75	8	12,338	4,364,772	10,226,883
1878	2,255	91	5	12,270	4,608,794	11,109,571
1879	2,811	97	2	12,300	4,692,175	12,148,609
1880	2,284	101	4	12,943	4,650,754	12,741,191

The last three columns that have been added to the above table will prove of interest if only by reason of their showing the magni-

tude of the interests involved in our friendly-society system, which cannot fail to be considered an ample justification for the prominence given to the matter. Although the manner in which the annual returns—which we learn from the Report for 1880 are now systematically examined—are filled up shows some improvement year by year, almost as many as twenty per-cent of them have to be returned annually for mistakes to be rectified or omissions remedied. This inherent defect no doubt arises from the deplorable ignorance prevailing among friendly-society officials; and it must be some time before the diffusion of knowledge respecting the technical portion of the subject is able to remove it. With respect to the number of members of societies making annual returns, it would be interesting if the information given were supplemented by a statement of the proportion which infants and juveniles bear to the total members. We have reason to believe that by some authorities the proportion is considered an unduly large one.

A few matters of detail may now briefly be alluded to. It will be remembered that under the Act of 1875 branches of societies previously registered as separate societies could be registered afresh as branches. This provision, it appears, has been taken advantage of to a very large extent, upwards of 6,000 cases of re-registration having taken place during the quinquennium 1875–80; and it is roughly computed that one-half of the registered bodies in existence belong to the federal type—a highly satisfactory circumstance when considered in the light of the Chief Registrar's assurance that "progress is visible in almost all the affiliated orders." The power given to the Registrar to prosecute societies neglecting to make the statutory returns have been locally made use of, and, although the Registrar seems to rely more on his power of cancelling a suspending registry to coerce defaulting societies into compliance with the law, a brief system of organized and vigorous prosecutions undertaken in several districts and counties at the same time might prove more speedily efficacious than less stringent measures. It is perhaps not surprising that the services of the public auditors should have been but little resorted to—for, in these days, almost every person considers himself capable of auditing accounts; and that the public valuers, who have, as a matter of course, been more largely employed, "have contributed much to the efficient working of the Act", is only what was to be anticipated. A circumstance that may well be regarded with feelings of satisfaction is the improvement in the condition of the insurances of children. Attention is more than once called to

the fact that the complaints of over-insurance in these cases are rapidly diminishing, and a better state of affairs seems, generally, to exist, as compared with the period preceding the passing of the Act of 1875.

It now remains but to make such general observations on the main subject as are prompted by a careful study of it in its various aspects. Before the passing of the Act controversialists seem to have been divisible into two chief parties: the one desirous of increasing alike the advantages and the obligations arising out of the state of registration; the other holding the opinion that "the paternal form of legislation" had altogether failed, and that it would be better public policy to allow friendly societies to look after their own affairs—in short to register under the Companies' Acts, and be on the same footing as other commercial undertakings. It was urged by the latter party that, although some failures might ensue from such a course, the general body of friendly societies would take heed by their example, and that in a very short time the industrial classes would learn to exercise prudence in selecting the associations in which their savings were to be invested. Waiving the point—a disputed one—as to whether it is reasonable to expect so much financial foresight from the lower orders, objection may be taken against these views, on the grounds, firstly, that such a procedure would be opposed to the spirit of all the laws dealing with the subject, from the time our legislators first took the matter in hand, as far back as 1789, and secondly—upon the authority of Mr. Ludlow, the present Chief Registrar, himself—that the societies refuse to be put under the Companies' Acts, and cling to the existing laws. Parliament, at any rate, decided to pursue the matter upon the same lines as had formerly been adopted; and, accordingly, we find in the resulting Act the privileges granted to registered societies somewhat enlarged, and the requirements made more exacting. But as has already been pointed out, the severity of the law and the increased vigour with which it is administered, have exercised a deterring influence on societies, and fewer new societies are now registered than was the case ten years ago. As a consequence, it does not cause surprise to observe that the Registrar, in referring to the point under notice, states the effect to have been the foundation of a large number of workmen's clubs of the worst kind; and these (unless a resettlement of the whole question should take place) will no doubt pursue the even tenor of their way, unfettered by legal obligations, until disaster overtakes them. It would certainly seem to be a matter

for serious deliberation whether an improvement would not be obtained if all societies consisting of a certain number of members, that may hereafter be formed with the object of granting the usual sickness and burial benefits, were compelled to register; and if the advantages of registration were made a little more tempting, there is no reason why projected societies should take objection to the requirement. It might even be enacted that all the existing societies should be obliged, after receiving notice, to register within a certain time. Again the opinion reigns in many quarters—such views were not long since advanced by Lord Lymington in a letter to *The Times*—that newly-founded societies should be compelled to have their rates of contribution certified by an actuary; but it is evident that unless registration were made compulsory, the weakest type of societies would not enter the fold, and this is of course highly undesirable. We find that in the Colony of Victoria (*see* Report for 1876, page 37), every new society is bound to register, and the tables must bear an actuarial certificate. The system is thereby rendered cumbrous, it is true; and we can well understand that such Government interference would not be accepted, without many protests, in the mother-country. But we do not anticipate that the larger and better-class societies would offer any serious resistance were such a modification in the law introduced, and a vital improvement would be effected, possibly with little trouble and at little expense. The arrangement might be simplified if, in the first place, the expenses of management were invariably to be met by levies. We should not, further, omit to bear in mind that the Act of 1875 requires contributions for deferred annuities, or pensions, to be certified actuarially; and if the rates for pensions, why not those for sickness and death benefits? The cases will seem to many minds analogous, and the same principle appears to be involved in each, namely, that when societies undertake for the regular payment of a fixed annual sum to provide a certain benefit at a future or an unknown period, it is essential to know that the bargain is a fair one, and that the annual sums, if properly accumulated, are as far as can be judged sufficient to provide the benefit. If this is not so, those who first claim upon the fund may exhaust the resources of the society, and the less fortunate members will find their investments consumed. Against such contingencies, it is surely sound policy that the provident poor should be protected, and this desideratum the Act of 1875 has quite failed to effect.

A proposition that has been advanced in one quarter, and which at least possesses the merit of originality, is that, with the view of effectually securing compliance with the law in spirit and in letter, a new class of Government officials should be created, whose duties it would be to act as inspectors for particular counties and districts, and who would exercise a certain supervision over the friendly societies of the locality—by seeing, for instance, that the annual accounts were duly audited and rendered, and that the valuations were made and sent in as required by the law. To the adoption of such a scheme there may exist objections alike of principle and of practice; but despite this, it will, we think, be expedient to bear it in mind when the subject again comes forward for settlement. Mr. Adler's suggestion that the Post Office Insurance Department and the friendly societies should work together, hand and glove, for the grant of death-benefits, will be so fresh in the minds of our readers as to need no more than a passing reference here; but as a valuable practical contribution to the main subject, it will doubtless receive the full consideration it merits. The close affinity between the Poor-Law burdens of the country and the solvency of our friendly societies—the importance of which, while it may easily be exaggerated, should not be overlooked—and the magnitude of the interests at stake, show how eminently desirable it is to strive to effect a reform in the existing state of affairs, and to establish our friendly societies upon a satisfactory and a solvent footing. The moral influence which such mutual associations exert is as salutary as it is widespread; and it speaks highly in favour of the spirit of thrift and independence actuating our lower classes, to find them so largely availing themselves of the means offered for self-provision in spite of the constant and repeated failures of the societies in which they have invested their surplus earnings. G. H. R.

Discussion on the Report of the Royal Commission on Friendly Societies.

[Abstracted from the *Insurance Record* of 8 Jan. 1875.]

Mr. W. P. Pattison in opening a discussion on the Report of the Royal Commission on Friendly Societies, (of which he was a member,) said that the first thing the Commissioners had done had been to show the misconduct of the Government itself—the confusion of past legislation—and it was well that that should be clearly set out

in order that it might be avoided in any future measure. The Report had done good service in making it clear that the causes of insolvency had not usually been wilful mismanagement, or the drinking away of the funds, but really the want of adequate knowledge upon the subject. It had also added materially to the knowledge of those even who were considered familiar with the subject. Very few persons had an idea of the extraordinary ramifications of the various societies, or the different classes into which they were divided, and he doubted very much whether many knew the extent of the business which they transacted. The Report had further clearly shown the inadequacy of the statistics which they at present had at command, and the necessity for further enquiry. And, lastly, it showed the necessity for the Government doing a great deal more than had been done hitherto. The facts to which he would specially refer would be, first, the number of people who were involved in the question. It was stated in the Report that there was evidence to support a belief that there were 4,000,000 of members of these societies, and that at least double that number were interested in their welfare; also, that there were 32,000 societies, with funds in hand amounting to £11,000,000. Next, he would refer to the general fact that it was believed already that the existing societies saved £2,000,000 per annum of poor rates. He did not doubt that there were many present who would agree with him that if they had been economically and skilfully managed, at least double that amount would have been saved. The subject which it seemed to him the Institute could best discuss would be the points raised in Chapter V, "On Rates of Premium and Statistics of Sickness, and on the Rate of Mortality prevailing among the Classes comprised in Friendly Societies", which was specially actuarial, and of which the responsibility had already been attached to him (the speaker) by the Chancellor of the Exchequer. One main point in that chapter was, that the present plan of Government in massing all these statistics of Friendly Societies into one table was not desirable, and that a far more useful result would be obtained by classifying societies and getting out statistics of the separate classes. In life assurance there was found to be a great difference in the mortality experience of different classes. The rate prevailing amongst members of the peerage and the clergy was essentially different from that of clerks, for instance, who were engaged long hours, and from people following special trades; and he believed that still greater variations prevailed amongst the various sections of the working classes. The classification of friendly societies with the view of getting out the mortality of the different classes, and the rate of sickness in special trades, was a subject which might well occupy the attention of the Institute. Another point that it was extremely desirable to discuss was whether, on a society being found to be insolvent, power should be given to the Registrar to readjust the contracts. This was referred to on page 185 of the Report, in these words,—"If the Government department superintending friendly societies were thus furnished with the actual experience of a number of well-known societies conducting their business in different counties, cities, towns, and villages, and if the condition of the members composing each was stated, the number pursuing each occupation,

the average amount of benefit for which the members contributed, it would be easy for the department to present the information in such a form as would enable persons starting societies, or boards of management conducting existing societies, to see which of the investigated societies were similarly circumstanced to their own. In addition to furnishing tables of premiums, the department might arrange for the valuation of societies, at a very small cost, and societies would have the opportunity at short intervals of adjusting the contributions or sick allowances when a surplus or deficiency of funds was discovered. Power should be expressly conferred on the department on the application of a certain number or a prescribed proportion of members to make a binding award to carry out the adjustment which may be necessary or equitable. Such a power might be exercised upon the application of 20 members, or if the society comprised less than 100 members, then one-fifth of the number of members." Whether it should be referred to the department, or the County Court of the district, was an extremely important question, arising as it would do out of the quinquennial valuation of the society. Another subject which should be discussed was the divergence in the opinions of the Commissioners, five of them recommending one course to be taken by the Government, and four another. He read a short summary which gave the views of the two sets of Commissioners upon an important point,—that was, as to whether the Government should merely aid these societies, as hitherto, with advice and give information, or whether it should go further, and say that certain societies, designating them Class A—were using sound tables of premiums and had come up to the standard of valuation, and that of other societies it knew nothing whatever. Poor people would then know which in the opinion of the Government were sound and which were in a doubtful position. The following was the summary of the two sets of opinions given by the Commissioners, as it appeared in one of the public journals:

"There is considerable difference of opinion among the Commissioners on the subject. The majority wish to retain the present Registrar, to give him assistants in the country, to empower him to register societies and issue certificates that they have complied with statutory requirements, as well as to give advice at his discretion to promoters and managers. They propose to issue a series of tables for the use of the societies, though they do not make that rule compulsory; that every society should be required to submit its affairs to valuation once at least in five years; that the law should enforce the keeping of accounts in a proper form; that an efficient system of audit should be introduced, with other supplementary provisions. But as far as we can judge, this is to do too much or not enough. It is sufficient to increase a liability, but not sufficient to obtain means to discharge it. If Government does all this for friendly societies, it will assuredly be held responsible for them. Just as now or more, the class affected—the poor and the uneducated—will mistake the effect of these provisions; they will see that they are lodging money with a registered, a certified, and a superintended society, and they will never dream that the Government which so registers, certifies, and superintends, does so equally, whether the society is sound or

unsound, solvent or insolvent. But such would be the case. The Commissioners propose that an actuary shall value the assets and the liabilities of the society once in five years at least; but they do not propose to make the position of the inspected society dependent on the result of the inspection. Whether that society turns out to be good or bad when its condition is examined, its legal status is unaltered. The worst society—that with the largest deficiency, that with the worst tables, the least care, and the largest expenses—is to continue to be registered, certified, superintended, and warranted equally with the best. If this recommendation be acted upon, we shall, in one respect, be worse in the future than we have been in the past; till now we have been able to hope at least that the societies which we fostered were solvent, but hereafter we shall see it in official figures that they are insolvent, and yet we are to go on encouraging them notwithstanding.

"It may be said that we ought to erase from the register the name of every society which appears to be insolvent. But this is not really possible. A society so degraded would be ruined. But if it were left to itself, and if those who managed it were judicious, it might easily regain soundness. There are many such institutions, which at first were ill-conducted, but which are now excellent because those at the head of them adopted better maxims. Nothing could be worse than that the State should patronize them in their first years, when from ignorance and from carelessness they are most likely to be managed ill, and then by discarding them destroy their credit, just when they were beginning to be instructed, and were about to manage well.

"A minority of the Commissioners wish, if possible, to cut more deeply at the root of fraud in these societies. They propose that under the new law it should be the duty of the Registrar, when rules or alteration of rules are tendered for registration, not merely to ascertain that the applying society has conformed with the law by inserting in its rules all required provisions, but also to examine its rates of contribution and benefit, and to advise, if need be, upon them, with a view to procure the adoption of such rates as will, apart from mismanagement or fraud, secure solvency. As it is not proposed that the Registrar should have power to *compel* the adoption of such rates, and his advice may fail to procure it, we suggest that it should be his duty to grant discriminating certificates of registration so as to make the difference generally apparent and easy of apprehension. Thus societies certified as having or adopting approved rates would, at least until their next periodical valuation, be in Class A, and would find it a useful privilege to describe themselves as such; whilst those societies which merely conformed with the law, but whose rates were not approved would be simply registered. We anticipate that this plain distinction would set members and intending members of friendly societies on enquiry, and would presently operate as a substantial guide and landmark, would bring societies in Class A into repute, and would suggest to the other societies the expediency of obtaining the like distinction."

In conclusion, he said that if the Government were to spend £100,000 a-year in aiding these societies, the expenditure would be

recuperative, seeing the very close connection which existed between their solvency and the amount of the poor rates of the country.

The President (Mr. Robert Tucker) said he was glad to hear Mr. Pattison admit the confusion of past legislation on the subject. He recollected that 30 years ago bill after bill was brought in to amend the laws relating to friendly societies, and he was often puzzled to know what the laws were. He was also glad to hear that many of the societies which had failed had not failed from dishonesty, but from want of knowledge and bad management. He had often been surprised that friendly societies had not done better than they had. No doubt many of the contributions had been inadequate for the benefits promised, but they must bear in mind that these societies had had a good deal of extraneous aid in the shape of subscriptions from honorary members, who had never called upon them for relief in sickness and had never intended to do so. He did not know that the data were inadequate, because a great deal had been done in that by Mr. Finlaison, and before him by Mr. Neison and others. He thought the general impression of the Commission was that the data were not sufficiently trustworthy and that further enquiry was necessary.

Mr. H. Harben was glad that the Commissioners were of opinion that it was not so much fraud in the management of friendly societies as ignorance that was at the bottom of their insolvency; because it struck him in reading the Report that throughout its pages there was an idea of a great substratum of fraud. He firmly believed the great majority of the failures had not arisen from fraud, but from a want of true knowledge of the principles on which the societies should be conducted. If the confusion of past legislation had been to a certain extent the cause of the errors, and fearful consequences which had arisen, why should they now adopt a *laissez faire aller* policy, and go to the extreme of paternal legislation, by having the variety of forms and penal consequences, which the late bill gave to all sorts of officers to be appointed throughout the country, to look into these societies? He was glad that the representations which were made to Sir Stafford Northcote induced him to withdraw that bill, and he believed that a bill more in accordance with Mr. Pattison's suggestions would be introduced in the next Session. Since the Report of the Commissioners had been made public, he had made it his duty to enquire of the large body of working men who had the management of these societies what were their feelings on the subject; and from the views he had elicited, he was certain that, if the legislation was of the kind proposed last session, it would simply increase the number of unregistered societies. If they were to have legislation on the subject it must be upon the principle, enunciated by Mr. Pattison, of a belief in the *bona fides* of the men who managed these societies; and, if they admitted that, the rest of the path was as clear as possible. At the present time any seven gentlemen might go to Serjeants' Inn and register a company, no matter whether it was to buy up the Bank of England or to construct a railway to the moon, so long as it was not against public policy or inherently wrong,—and there was no limitation as to the amount of capital or the conditions under which the company should be managed; but there were certain proper clauses

providing that if incorrect returns were made it should be a misdemeanour. They were bound to register proper accounts, and there were various safeguards laid down which all prudent and honourable men ought to observe. Now, why should not the working man have the same advantages as the ordinary merchant or tradesman? The building societies were legislated upon last year, and in that Act there were no penal clauses such as the Commissioners recommended should be adopted in the Friendly Societies' Act. Building societies were framed upon the model provided by the Joint Stock Companies' Act, adapted to the circumstances of friendly societies, and why should not friendly societies be regulated by the same principle? He could not see the advantage of having certificated and uncertificated societies. No one knew better than the President that the question of solvency was not a mere matter of figures. Two societies, each of ten years' duration, with the same amount assured, the same amount of funds, and the same amount of annual income, might yet be totally different as regarded their soundness. It was impossible to grind out of an arithmometer the exact position of the respective societies, unless at the same time regard was had to the quality of the lives insured and the prudence of the management. Then, he did not think that the failures of these societies had arisen altogether from insufficient data, inasmuch as they, as actuaries, had been called upon to advise them. Many years ago his opinion was sought by one of these societies, and he advised them to increase their rates 30 per-cent, but they would not do it. Working men would not pay the money, but trusted to what they called the power of the levy to make up any deficiency. He would not say that the data were as reliable as the Institute of Actuaries would desire, but they so nearly approximated to the truth that, in dealing with a large body of men, there was no difficulty in fixing a standard of safety. With regard to the tables to be used for certain societies, perhaps Mr. Pattison could tell them whether they were to be based on geographical position or occupation, because in either case he foresaw great difficulties in the way. They all knew that Yorkshire and Lancashire were great seats of manufacturing industry, but a few years ago Barrow-in-Furness and Middlesborough, which had been agricultural districts, suddenly sprung up as manufacturing towns, and were at the present time the busiest hives of industry in England. In such a case, if rates for geographical position were to be observed, at what particular period of the transition would they come into operation? If, on the other hand, the rates were to be upon trade, take the case which occurred last year in the eastern counties. The agricultural labourers struck, and got employment in the ironworks at Middlesborough and Barrow-in-Furness, and after a few weeks they returned to the agricultural districts. How could these men be dealt with? They could not be expected to pay additional premiums for the few weeks they were engaged in the iron trade. The question was whether, in dealing with large bodies of people in England, it would not be better to adopt some more general principle, so as to have certain tables which would be sufficiently practical for all purposes. A very strong feeling existed on this point among working men. Even a Sheffield knife-grinder could not understand why he should pay more premium, or have less benefit,

than any other ordinary workman. With regard to the suggested Government certificate, it struck him that if they were to have certificated and uncertificated societies, they would get into a state of great confusion. It was better to let the working classes still have a few falls and recover their strength, than to lead them in the leading-strings of hot-bed legislation. The late Mr. Tidd Pratt was a registrar without power, and the societies could do almost as they liked. What was wanted was a registrar armed with great power to enforce the rules, and any step in that direction would be commendable and useful; but if the recommendations of the Commissioners were carried out in their entirety, he believed that in a few years they would find they had not accomplished that which he was certain they really and truly wished to do—the improvement of friendly societies and the working classes. In answer to the President, he said he would have all societies registered. His belief was that if they removed difficulties, every society would register; whereas if they put difficulties in the way they would not get any to register.

Mr. S. Brown said that having had some experience in connection with friendly societies, he could strongly confirm the views which Mr. Pattison had expressed, as to the great anxiety on the part of the members to carry out these societies upon the soundest principles. It was their ignorance which had caused so many failures. He agreed also that there must be different classes of tables appropriated to different classes of persons, but at the same time he did not believe they would do any good by endeavouring to multiply too much the various classes into which these societies might be divided. Take, for instance, the agricultural labourer. There was no reason why he should be different in the north from the south. A body constituted of working men of various occupations in towns, none of which presented any very material or extreme hazard to health, but which one with another must have some danger in them, might all be placed in one large and general table. In other instances, they would find classes so distinct that it would be impossible to put them in the same class of table. Take, for instance, coal and lead miners, who differed essentially in their character as miners, but neither of whom could possibly be placed on the same footing as agricultural labourers or the inhabitants of a town. They might suggest to the Government various classes of tables which might, on a broad scale, be fairly brought out by means of new data to be obtained, and by which they might fill up many of the gaps in the old data where they were certainly defective. He alluded more particularly to the want of information with regard to superannuation. Up to certain periods of life, say 40 or 45 years of age, any society might go on safely; and even if it failed, the difference in the rate of premium, between one set of men of one age and another set of another age, was so small that no great injustice would be done to any body of members. But when a member had been saving from youth to 45 or 50 years of age, and was then ceasing to be able to obtain a livelihood for himself and his family, and was looking to his society as almost the sole means he had left, it was much to be deplored that the information regarding the amount of superannuation he could receive was very defective,

and that the societies often began to break up when they became of the greatest consequence to the working man. It was possible that if they could have analyzed the old tables they would have found the materials there, but it was not worth while to analyze the tables which Mr. Finlaison had judiciously used so far as he went, although he (Mr. Brown) thought he might have given them more information from the body of facts laid before him. They might collect from a few well-considered societies facts which would enable an actuary to render great assistance to the Government, and at the same time aid working men in carrying on these great societies, which were of so much importance to them.

Mr. F. G. P. Neison said that one grave fault of the Report was that the Commissioners evidently had the idea that the stability of a society was to be measured by the amount of funds it possessed; but that was no possible test of solvency. The question of solvency must mainly depend upon the relation of the contingent assets to the contingent liabilities. During the last few years he had had the affairs of many hundreds of these societies before him, and he would give one or two instances showing how fallacious such a test would be. He had the case of two societies in which the amount of funds in hand were in both instances £21 per member. In the one society, after an actuarial valuation, the same data being used in both instances, there was a surplus of about £9,555, and in the other a deficiency of about £10,000. Taking another instance, there was a society bordering the county of Middlesex, which separated its members into classes, those who joined before 1853 and those who joined subsequently. In one class the funds in hand were £45, and in the other only £9 per member. After a valuation made a few months ago, it appeared that in the class with £45 there was a deficiency of over £7,000, and in the class with £9 there was a deficiency of £2,800. To take an extreme case, he found that one society having in hand £5 per member was in a better position than another having £680 per member. [Mr. R. P. Hardy—How many members?] There were only ten members in the society having £680 per member in hand. It was essentially an annuity society. In the other case there were 1,800 members, a sufficient average number to proceed upon. The chapter on data should have been the strongest in the Report, but instead of that it appeared to him to be the weakest. Numerous data were noticed, but those in connection with nearly all the leading annuity societies were entirely ignored. The English Friendly Societies' Experience, embracing 3,000,000 of observations, the largest data which had been tabulated, and closely approximating in their results to the Manchester Unity of Odd Fellows, had not been noticed. [Mr. Pattison—Where published?] They were not published, but at the request of the Commissioners they were supplied with the particulars. He thought the proposed method of tabulating the new data would prove a complete failure. It might be very interesting to have some further particulars as to the influence of occupation upon mortality and sickness, but for all practical purposes, taking nine societies out of ten, the only data which would be available for them would require to be based on the average, if not on the whole kingdom, at least upon a number of

occupations. In numerous instances societies had been founded solely for agricultural labourers, miners, or tradesmen, and in only a few instances had the members who had entered them been engaged in the particular occupation specified. He had no doubt that some good would result from the report. The recommendation in the body of the report that the rates of contribution for deferred annuities should be certified by an actuary was a good one; but it was strange that for sickness benefits and widows' and orphans' funds no such certificate was to be required, especially as only one society in about 500 undertook deferred annuities, whereas they all undertook sickness risks, and it was these in the past which had undermined their stability. The Commissioners recommended that valuations should be made periodically, but had given no information as to what test should be applied to determine the solvency or insolvency of a society. He thought that, speaking generally, the less legislation there was on this subject the better. He had not much faith in compulsory power in connection with these societies. The members themselves were anxious to amend their institutions, as was shown by the large sums which they had spent at different times in tabulating data, the Manchester Unity alone having spent sums varying from £2,000 to £3,000 for collecting facts not merely for their own use, but for the good of the public at large. He was, therefore, for letting well alone. Theoretically, there were only two things absolutely necessary for a friendly society. First, to start with adequate rates of contribution; and secondly, every now and then to examine whether experience necessitated any alteration of these rates. The advantages resulting from registration were so slight that if they rendered it less tempting by enforcing restrictions the societies would cease to register. Any certificate that might be given by the Board of Trade or Registrar of Friendly Societies should be a stamp of solvency and legality. At the present moment there was this anomaly, that many of the registered societies were utterly insolvent, and many of the unregistered ones were perfectly solvent. If registration were rendered compulsory, then he agreed with Mr. Pattison in thinking that it would be advisable to have two classes of societies—one, call it A, that merely complied with the requisites for registration, and the other B, which not only did that, but at the same time gave some proof of solvency. Of course, if the latter plan were adopted, it would be necessary that the Society should go before the Registrar once in five or seven years, in order that the certificate might be renewed, endorsed, or altogether withdrawn.

Mr. C. Walford regarded the reports of the Commission as very valuable contributions to the literature of friendly societies. It puzzled one to understand why, after having obtained so much information, the Commissioners had made so little use of it. It seemed to him possible to have devised a simple remedy for a great many of the difficulties which had arisen, and that remedy was more of a legal than an actuarial character. When a society was formed it should be compelled to have a memorandum of association, after the manner of joint-stock companies under the Companies' Acts of 1862 and 1867, stating briefly and tersely the objects for which it was established, the amount of subscriptions, and the benefits

intended to be conferred. If such a memorandum were insisted on, the Registrar would be able to see at a glance what was contemplated by the society, and much of the nonsense which now often got incorporated into the rules would be prevented. He would have every society registered, and the certificate should only be issued for three or five years, as might be determined upon. By a simple machinery of that sort, these societies would be put on a sound foundation. He did not believe that the intentions of the working men were dishonourable. It was only foolish people outside who would attribute dishonour to men who played with their own money. They all intended to do the right thing, but wanted a sort of central bureau where they could get assistance. He believed that the late Mr. Tidd Pratt did a great deal of good, but that he had not a staff equal to his requirements. The notion of having sub-registrars in different parts of the country was so wild that he wondered at its having been proposed. It would open the door to all sorts of corruption. What was required was an efficient registrar with a proper staff, to see that the simple requirements he had mentioned were thoroughly carried out.

Mr. H. A. Smith called attention to the fluctuation to which sickness was liable in any limited number of men, remarking that it was much greater than in the case of mortality. In order to meet that, Mr. Babbage, in his evidence before one of the old Commissions, recommended that different sets of tables should be drawn up on the basis of the number of members in the respective societies. It was, however, easier to point out one evil like that than to provide a remedy; but the simplest way of dealing with it seemed to him to be by legislating upon a minimum number, below which no society should be allowed to exist, say 200 or 300. No doubt in the new bill some power would be given for a voluntary winding-up of societies, but he thought that that should not be resolved upon by any proportional number, such as four-fifths or five-sixths, ignoring the individual interests of the members. It might happen that a small minority of the members having reached a good age, would have great interests at stake, whereas if there had been a large infusion of new blood, the majority would have little at stake, and might think it a convenient time to wind up.

Mr. M. N. Adler thought there might be some advantage in having societies consisting of a small number of members, inasmuch as they could watch each other and thus prevent any unnecessary calls upon the funds for sickness; but, for all that, he could not help thinking that some 100 or 200 were required to form anything like an average. He trusted that efforts would be made to get out the mortality and sickness of different trades. Such classifications should not be geographical, but according to occupations, after the manner of Mr. Ratcliffe's tables. Mr. Pattison had suggested as one point for discussion, whether in the event of an actuarial valuation showing that the liabilities of an institution should be reduced, the society or the department should have the power to do it. Such power had been conferred in the case of life assurance companies, by the Life Assurance Companies' Act, but it had not been set in motion, and if it were he did not think it would

be very successful.* If a society resolved to reduce their liabilities by 10 per-cent, it would follow that all those who had recently assured would refuse to pay a full premium to get a reduced benefit, and would drop off, leaving only the deteriorated and older lives for the society to grapple with. Such an operation would be rather to bring on the day of reckoning than to save the institution. The same remark held good in the case of friendly societies, and therefore he for one could not look upon that proposition with favour. The Commissioners, in various places, spoke of the desirability of having separate funds for the different classes of benefits, but he could not see how in any legislation it would be possible to provide for anything of the kind.

Mr. W. B. Hodge agreed very much with Mr. Harben, that we had sufficient data for the management of friendly societies if they were properly employed, and that the failure of such societies had not arisen so much from dishonesty as from ignorance. The members would not pay the rate of premium necessary to keep a society solvent, and this he attributed to the competition of those societies which were satisfied with insufficient premium. In the case of one society he pointed out to the clergyman of the parish who consulted him that the allowance for sickness was too large. "Oh", was the reply, "we must give that because they do in the next parish, and unless we do the same all our people will go there."

Mr. A. H. Bailey said that with regard to the minimum number of members in a friendly society, it must be borne in mind that trade was also an element. It was well known that an epidemic in one year was generally followed by a corresponding immunity in another year. There were few country parishes in which there were more than 500 eligible members, and it appeared to him that, all things considered, 100 would suffice to give a safe average. He thought that the well-to-do classes expected far too much from these societies in the way of reducing the poor rates. If it were possible,—although he should not recommend it—that societies could be prohibited from entering into contracts for deferred or quasi-deferred annuities, or even for sickness after a certain age, it would be a material advantage. The bulk of men could not afford to save up during their working years sufficient to make their own fortunes. Clerks were not able to do anything of the kind, and the notion that an agricultural labourer could begin at 20 years of age and lay by for 45 or 50 years sufficient to provide for himself in old age was pure delusion. And if he could do it, he ought not to do anything of the sort. He spoke that perfectly seriously. Any man who had children to provide for and put out in the world had far better have his money under his command. To recommend him to put his money for such a long period wholly out of his control, to provide for himself in old age and to leave something to those around him, was most unwise, because he would not be able to accomplish his object. If friendly societies were restricted to sickness business they would get on much better than at present.

Mr. R. P. Hardy remarked that something similar to what

* This has since been successfully carried out in the case of the Great Britain Mutual Life Assurance Society.

Mr. Bailey had suggested was recommended by Mr. Jellicoe, in his evidence before the previous Friendly Societies' Commission. Mr. Jellicoe recommended that these clubs should confine themselves to small funeral allowances and sickness benefits; but when it came to a question of accumulating funds in order to purchase deferred annuities, he said they had better transform themselves into collecting machinery and pay the money over to the National Debt Office. How was it possible for a society with 100 members to build up a fund that they could depend upon in old age? With regard to the general intelligence of those people to manage their own affairs, he had been struck with their thorough comprehension of what they wanted. As to whether occupation or geographical disposition should be taken into consideration, he might mention that he had recently had the affairs of a large society under his consideration. It was in what he should call a very low wage district, among the East Anglian peasantry, and there was undoubted indication that these men had insufficient nutrition, for they were not merely frequently attacked with sickness, but the periods of suffering were long, although the rate of mortality was singularly low. He came to the conclusion, therefore, that these men had good constitutions, but succumbed very readily to the climate, which perhaps more beef and less beer would enable them to resist.

Mr. A. J. Cook thought that, for the reasons stated by Mr. Adler, some check might with advantage be put upon the undue multiplication of friendly societies. The large affiliated orders exercised by their own laws a power of the kind with respect to the opening of new branches, and often recommended the amalgamation of existing courts and lodges, but there was no check upon the formation of other classes of friendly societies. He submitted that societies seeking registration should be compelled to deposit a certain amount, until their incomes had reached a point to be determined upon, and he would graduate the amount of the caution money required, making a society which took power in its rules to appoint agents or collectors —and without such power a society should be bound to be merely local—deposit a larger sum than local societies. This would put a salutary check upon the creation of bubble office clubs and burial societies, which from their close resemblance to ordinary insurance companies had in times past brought some little discredit upon insurance transactions generally. He considered that accounts should be deposited with the Government, and that the returns should include a summary of the valuation, but that quinquennial experience returns should not be enforced unless paid for by the Government. The expense and labour of preparing them, especially in the case of centralized societies like office clubs or burial societies, was more than they could bear, and he could not see why they should be required to do more in that matter than the ordinary insurance companies.

Mr. Pattison, in reply, said that, with reference to Mr. Harben's question, he did not know whether it was the intention of the Commissioners to deal with friendly societies on a geographical or trade basis. They simply said that it was necessary to collect information and then to group it, and he believed that they would leave it to the competent staff to be appointed to say in what way it should

be dealt with. It was clear to those who had seen the returns of certain districts that a very great diversity in the experience was observable. In Liverpool, for instance, it was different from an inland town; and on making further enquiry they found that the difference was caused rather by occupation than by density of population or the quality of the atmosphere. Though it was suggested that a large number of separate societies should send in returns of their experience, it did not follow that a large number of them might not be grouped with advantage. That was, indeed, quite in contemplation, but it would be clearly beside the mark to suggest how the facts should be grouped until they were all collected. Mr. Harben had made another suggestion which had taken root in high quarters, that one table should be constructed for use among all classes. Immediately before this Commission was appointed he (Mr. Pattison) was asked by Mr. Lowe, who was then Chancellor of the Exchequer, to call upon him. He did so, and found that the right hon. gentleman was at once for abolishing the office of registrar, and forming the societies upon one principle, the Government being no more responsible than for joint-stock companies; but when it was pointed out to him that a number of societies were unsound, through ignorantly charging inadequate premiums, he at once replied, "Then this is a subject for a Royal Commission." If a minimum table were formed and recommended by the Government, as contemplated by Mr. Lowe, and all societies were founded upon it, the responsibility of the Government would be far greater than it was at present. It was certain that such a table would be wholly inadequate for a large number of trades, and the members of societies who found it leading them to insolvency would naturally complain of the Government action in the matter. He (Mr. Pattison) thought that the thing was wholly impracticable. What was wanted was a series of correct tables applicable to the various classes. With respect to the question of fraud, in three cases out of four insolvency was caused by inadequate premiums, but he did not say that a large proportion of the other fourth were not due to fraud. Mr. Neison had stated that the Report did not treat of the English Friendly Society Tables, which were not published. If a commission were appointed to enquire into the tables of mortality it would scarcely be justified in reporting upon the various private tables in use in the different offices. It could treat simply of the tables, the data and formation of which were known, and the extent to which they were used. The manuscript tables to which Mr. Neison had referred could not be taken cognizance of; but if they were preferable to any other set of tables, the sooner they were published, with full information of the data collected, the better. Mr. Neison had also said that the Report recommended that the actuary's certificate for annuities should be continued. The bill might have done so, because for convenience it adopted a great many of the clauses of the existing Act; but he did not think the Commissioners contemplated anything of the kind, as they were quite as anxious that the tables of premiums should be right as that the tables of annuities should be right, and that they should be revised from time to time by quinquennial valuations. Mr. Neison seemed averse to anything except registration, and would let well alone.

The whole tenor of the Report was to show that "well" did not exist, and that was the very reason why it should not be left alone. Mr. Walford had referred particularly to the district registrars, and seemed to be under some misapprehension as to their functions. The power, and all the important duties, would be confined to the central office. The district registration offices were simply for the purpose of giving facilities for seeing the returns made to the central office, which would send down to the local office the tables and the quinquennial report; so that people coming to a market town could see all the returns with respect to the societies in their district. He did not think it was intended to give them any administrative functions whatever, and believed that it would be very mischievous to do so. Mr. Ambrose Smith had spoken of the fluctuations of sickness in small numbers. He (Mr. Pattison) would direct his attention to some papers by Mr. Tomkins on friendly societies, in which there were some interesting facts on that point. For certain purposes these societies might be affiliated. A few of them in a county, having confidence in each other, might contribute every few years one-half of their surplus to a common fund, so as to make good the deficiency of any society that had experienced an excessive rate of sickness. County societies were partly framed with that object, and he thought it would eventually be shown that the principle would work well. As to inadequate rates, his own experience was very much like that of Mr. Hodge. When he was connected with the Working Men's College, some of the men there had belonged to a society which had dissolved, and it was thought that with the large number of intelligent workmen there they might form a good society. Accordingly Mr. Tom Hughes and himself started one, and when they announced the rates they were found to be about 30 per-cent above their neighbours. They got about 40 members in the course of the year, and then finding that even the intelligent men of the Working Men's College did not care to pay more than the members of other societies they closed the society and returned in full the premiums.

On the Rate of Mortality in the Navy. *By* T. B. Sprague, M.A., *President of the Institute of Actuaries.*

I HAVE lately examined the Blue Book on the Health of the Navy for the year 1878, in order to ascertain whether the information contained in it could be utilized for life insurance purposes. I thought that it might perhaps assist the Actuary in fixing the rate of extra premium to be charged for sea risk; but the general conclusion at which I have arrived is, that while the information contained in the Blue Book is extremely valuable for the purpose of estimating the healthiness or unhealthiness of different naval stations, and the special risks that have to be guarded against

in each, and for other kindred purposes, yet the information is of very little value (if any) to insurance companies. It may, nevertheless, be useful to lay before the readers of the *Journal of the Institute of Actuaries* a few of the figures contained in the book.

It is stated that the total force in the service afloat, in the year 1878, corrected for time, was 47,400. The total number of persons invalided was 1,662, and the total number of deaths was 669; but the latter number includes 311 deaths caused by the loss of the *Eurydice*. Taking the Home Station, we are informed that the force employed during the year was composed of 65 vessels, namely: 7 ironclads, 1 second-rate, 1 third-rate, 1 sixth-rate, 11 stationary ships, 9 drill ships, 11 coast-guard ships and 2 tenders, 6 training ships, 5 training brigs, 1 troopship, 2 steam vessels, 1 despatch vessel, 2 yachts, 1 storeship, 3 gunboats, 1 torpedo depôt ship. Of these, 36 were seagoing ships, and the remainder stationary. The mean force corrected for time was 19,000. The number of officers and men invalided during the year, was 642; and the number of deaths, 137. The distribution of these casualties according to age, is shown in the following table:

Table 1.

Ages	Home Station					Select Insured Lives	
	Mean Force	Died	Percentage of Mean Force	Invalided	Percentage of Mean Force	Central Rate (percentage)	
						Death	Impairment
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
15–25	10,290	60	·58	385	3·74	·45	·38
25–35	5,220	40	·77	129	2·47	·46	·52
35–45	2,670	30	1·12	100	3·75	·55	·61
45–	820	7	·85	28	3·41	·70	·90
Total	19,000	137	·72	642	3·38	·51	·54

No information whatever is given as to the ultimate fate of the 642 persons who were invalided. Probably some of them regained their health and rejoined the service; and if the number of these were stated in the report (which could, I suppose, be done with comparatively little trouble), the value of the statistics would be considerably increast. The remainder, or the greater number of them, would, I suppose, be incapacitated through ill-health

from further naval service, and many of them would die within a few years from the diseases for which they had been invalided; and although the survivors might so far recover as to be able to undertake light work, they would probably be always subject to a much higher rate of mortality than the normal rate for their age. They would, in fact, be what we technically call damaged lives. It is clear from this statement that any attempt to compare the above rates of mortality with those exhibited by any of the ordinary tables, is quite hopeless. The officers and men under observation, are all healthy lives at the time when the observations commence; and the average standard of health among the lives under observation, is maintained by the constant invaliding of those persons who have fallen into chronic bad health. These conditions are quite different from those which prevail among the bodies of lives from whose experience ordinary mortality tables have been compiled; and any comparison with the figures furnisht by them, would therefore be misleading. A comparison may be more appropriately made with the mortality among recently selected lives, that is to say, among insured lives in the year immediately following their insurance; and my Select-Life Tables (*J.I.A.* xxii, 391), enable us to make such a comparison. The rates given in the Blue Book, and quoted above, are calculated upon the total number constantly at risk during each interval of age, so that they are, in fact, the central death-rate and the central invaliding rate, for the several periods of years under observation; and the figures given in my paper above referred to, have to be modified accordingly. I have therefore calculated the central death-rate at the ages 15–25 by the formula

$$\frac{d_{[15]}+d_{[16]}+\ldots+d_{[24]}}{l_{[15]}+l_{[16]}+\ldots+l_{[24]}-\frac{1}{2}(d_{[15]}+d_{[16]}+\ldots+d_{[24]})},$$

and similarly for the other intervals of age; and the values thus obtained are inserted in column (7) of the above table. The comparison for ages above 45 is very uncertain, in consequence of all the lives above that age being thrown into a single group. I have assumed that the number of lives above the age of 50 is very small, and have therefore calculated the ratio for the ages 45–50.

As already intimated, the persons invalided correspond to a certain extent to the "damaged lives" of my tables; and I will now compare the numbers invalided, with the numbers becoming damaged according to them. Taking any age x, at which the

number of healthy lives is $l_{[x]}$, the number of these surviving at the end of a year, is $l_{[x]+1}$; and the number that are still healthy, is $l_{[x+1]}$; therefore the number who have become damaged in the year, is $l_{[x]+1} - l_{[x+1]}$. Thus for age 30 we have $l_{[30]} = 862{,}820$, $l_{[30]+1} = 858{,}936$, $l_{[31]} = 854{,}970$, and $l_{[30]+1} - l_{[31]} = 3{,}966$; so that the percentage of lives that become damaged in the year, is ·46. The number who die in the year is 3,884, so that at this age the number becoming damaged in a year, is almost exactly equal to the number who die in the year. Taking now the interval of age, 25–35, the central rate at which the lives become damaged, (or the central rate of impairment), is calculated for the purpose of comparison by the following formula:

$$\frac{G}{l_{[25]} + l_{[26]} + \ldots + l_{[34]} - \frac{1}{2}(G + d_{[25]} + d_{[26]} + \ldots + d_{[34]})}$$

where G = number becoming damaged

$$= l_{[25]+1} + l_{[26]+1} + \ldots + l_{[34]+1} - l_{[26]} - l_{[27]} - \ldots - l_{[35]}.$$

It is found that at these ages the rate is ·52 per-cent; and the rates similarly calculated for other intervals of age, are given in column (8) of the above table.

Comparing now the figures in columns (4) and (7), we see that, at every group of ages, the death-rate in the Naval Service on the Home Station, is decidedly higher than among the insured lives; but possibly the difference is not sufficient to make an extra premium absolutely necessary. When, however, we proceed to compare the rates of invaliding in the Navy with the rate at which select lives become damaged, we see that the differences are very much larger. At ages 15–25 the percentage of the select lives that become damaged, is only ·38; while the percentage of invaliding in the Navy is almost ten times as large, namely 3·74. This proportion becomes gradually less with increasing age, but at the highest ages the percentage for the Navy is about four times that for the select lives. In making this comparison we must not forget that all the damaged lives according to my table die within five years, whereas, as already mentioned, some of those who are invalided probably regain their health; but when the largest possible allowance is made for this, it is clear that the rate of invaliding in the Navy, will be several times greater than the rate at which select lives become damaged; and the unavoidable inference is that, if we could trace those lives which have become invalided, so as to include the deaths among them with the deaths

among those who remain in the service, we should get a death-rate very much higher than that which prevails among insured lives. Thus, then, we arrive at the conclusion that naval service in the healthy Home Station, is attended with special risks to life and health that necessitate the charging of an extra premium; but we have no means of estimating what that extra premium should be.

Table 2 (p. 54) shows the percentages of the Mean Force in each station, which died and were invalided in the course of the year; also the corresponding figures for the Total Force.

As indicated in the table, the Home Station is one of the healthiest in the service; but in the year under consideration the death-rate was somewhat lower in three other stations, namely, the North-American and West Indian Station, the Pacific, and the Australian; and the rate of invaliding was lower in three stations, namely, South-East Coast of America, Pacific, and Australian. The deaths caused by the loss of the *Eurydice* are included among those of the Irregular Force, and have the effect of raising the death-rate in that Force far beyond that of all the other Forces. As that was quite an exceptional event, a juster view will probably be obtained by excluding the deaths arising from it. I have therefore given at the end of Table 2 the figures relating to the total force exclusive of the Irregular Force. Here it will be seen that the irregularities in the percentages of the different Stations, are to a very great extent removed; the percentage of deaths being ·67 at ages 15–25, ·80 at ages 25–35, 1·15 at ages 35–45, and 1·22 above the age of 45. Comparing these percentages with those that relate to the select insured lives, we see that they are on the average fully 50 per-cent higher; and the rate of invaliding at all ages, is about seven times the rate of impairment among the insured lives. These results show that, taking the naval service as a whole, there is a very considerable risk of danger to life and health; and they might possibly, in the hands of a skilful computer, enable an approximation to be made to the amount of extra premium that would be necessary to cover this risk.

TABLE 2.

Table showing for the year 1878 *the Mean Force of the Navy at decennial intervals of Age in the various Stations, and the percentages of this Force which Died or were Invalided in the course of the year.*

Ages	Force	Died	Invalided	Force	Died	Invalided	Force	Died	Invalided	Ages
	HOME STATION			MEDITERRANEAN			NORTH AMERICAN AND WEST INDIAN			
15–25	10,290	·58	3·74	4,660	·82	4·14	1,440	·42	2·57	15–25
25–35	5,220	·77	2·47	2,550	·90	4·75	870	·46	3·45	25–35
35–45	2,670	1·12	3·75	860	·81	5·47	270	·74	7·04	35–45
45–	820	·85	3·41	160	2·50	6·25	40	·00	15·00	45–
TOTAL	19,000	·72	3·38	8,230	·87	4·51	2,620	·46	3·51	TOTAL
	SOUTH-EAST COAST OF AMERICA			PACIFIC			AFRICA, WEST COAST, AND CAPE			
15–25	300	1·00	2·00	870	·46	·72	850	·71	3·53	15–25
25–35	220	·45	2·73	620	·65	3·06	540	·74	4·81	25–35
35–45	60	1·67	8·33	230	1·30	3·04	140	2·14	12·14	35–45
45–	10	·00	10·00	20	·00	5·00	20	·00	15·00	45–
TOTAL	590	·85	3·05	1,740	·63	2·41	1,550	·84	4·90	TOTAL
	EAST INDIAN			CHINA			AUSTRALIAN			
15–25	1,240	1·13	4·11	1,400	·71	2·57	510	·78	1·76	15–25
25–35	740	2·03	4·05	1,050	·38	5·52	230	·43	·87	25–35
35–45	190	1·58	14·74	270	1·85	5·93	90	1·11	2·22	35–45
45–	30	·00	20·00	40	7·50	7·50	10	·00	·00	45–
TOTAL	2,200	1·45	5·23	2,760	·80	4·09	840	·71	1·55	TOTAL
	IRREGULAR FORCE			TOTAL			TOTAL, EXCLUSIVE OF IRREGULAR FORCE			
15–25	3,750	6·80	2·32	25,310	1·58	3·35	21,560	·67	3·52	15–25
25–35	2,160	3·33	2·27	14,200	1·18	3·31	12,040	·80	3·50	25–35
35–45	840	3·10	3·93	5,620	1·44	4·88	4,780	1·15	5·04	35–45
45–	120	5·00	9·17	1,270	1·57	5·43	1,150	1·22	5·04	45–
TOTAL	6,870	5·23	2·62	46,400	1·44	3·58	39,530	·78	3·75	TOTAL

On Mortgages of Reversionary Interests. By HENRY GODEFROI, LL.B., B.A., *Barrister-at-Law, Author of the "Law of Trusts", and Joint-Author of "The Law of Railway Companies."*

AMONGST the various descriptions of securities, whether requiring for their absolute safety the insurance of a life or lives or not, it is well known by those who are called upon to advise lenders with regard to them, that none require more anxious care and caution than dealings involving expectancies, reversions and post-obits. A long course of judicial decisions makes it manifest that our Courts are averse from giving any facilities for enabling persons entitled to such interests to obtain money on them; and until the Legislature interfered to modify the doctrine so often enunciated by the judges, so far at least as *sales* of reversions * are concerned, the purchase of expectant titles was rendered almost impossible. But even the Act to which we allude protects the purchaser only in a modified degree, for instead of relegating his position to that of ordinary purchasers of other kinds of property, it enacts merely that a sale, otherwise *bona fide,* and without fraud or unfair dealing, is not to be set aside on the ground of undervalue alone. We have intimated that this enactment applies only to sales of reversions. This is the received opinion in the legal profession, although it is quite arguable, from the scope of the interpretation clause in the Statute, that it might be held to apply equally to advances on reversionary interests. However this may be, we are entitled, in the absence of direct judicial authority, to assume that the Sales of Reversions Act does not in any way affect mortgages. To this day, therefore, we may affirm that the reluctance of the Courts to recognize the hypothecation of future interests is as strong as it was at the time when Lord Chancellor Hardwicke pronounced his judgment in the leading case of *Chesterfield* v. *Janssen,* now nearly one hundred and forty years ago; bearing in mind also that his Lordship was then but declaring a state of the law which dates from the earliest foundation of equitable jurisdiction in England. We are not concerned to urge an amendment of the law on this head, nor from some points of view would it, in our opinion, be desirable to relax the fetter which must undoubtedly restrain many unprincipled persons from obtaining advantages over others not so skilled as themselves in business affairs. The cases which have come before the Courts have so often disclosed

* 31 & 33 Vic. c. 4.

details of fraud and oppression of the most shocking nature, that on the whole the rule (which, for the purposes of this paper, we shall presently enunciate) may be regarded as a wise and salutary one. Lord Hardwicke himself described the character of the frauds which usually marked these cases, of course referring only to those which came within the doctrine he had laid down, as follows: "There is always fraud presumed or inferred from the circumstances or conditions of the parties contracting—weakness on the one side, usury on the other, or extortion or advantage taken of that weakness. There has been always an appearance of fraud from the nature of the bargain. . . . . In most of these cases have concurred deceit and illusion on other persons not privy to the fraudulent agreement. The father, ancestor or relation, from whom was the expectation of the estate, has been kept in the dark; the heir or expectant has been kept from disclosing his circumstances, and resorting to them for advice, which might have tended to his relief and also reformation; this misleads the ancestor, who has been seduced to leave his estate not to his heir or family, but to a set of artful persons, who have divided the spoil beforehand." This language, no doubt, might be considered as a little wide of the mark, especially with regard to the deception said to be practised upon the ignorant parent or relative, and in using it Lord Hardwicke possibly had in his mind, what has since pressed upon some very learned judges in dealing with cases of the kind in question, namely the importance of protecting the family property from being wasted by a possible successor to it. Whether this be so or not, it has now become well settled that the severity of the Court in adjudicating upon these cases, is not founded upon motives of that character, but bases itself merely upon the general abhorrence of equity to any kind of covin, overreaching or actual fraud. Bearing in mind, then, the reasons which actuated the Court of Chancery in throwing its protection in a special form around expectant heirs and reversioners (which term is held to include remaindermen), the result has been that transactions by way of mortgage with such persons are regarded as voidable; that is to say, that if they choose to attack the validity of the security they have given, it is the duty of the parties taking the security to defend themselves; or, in other words, the burden is laid upon the latter to prove the strightforwardness of the dealings so brought into question. This obligation at once shows in the clearest light the nature of the risks incurred by mortgagees of interests of the

kind under consideration. The borrower comes forward with a claim to set aside the security as an unconscionable bargain, and the lender, instead of having to meet a case made against him by replying to detailed evidence of the nature of the objections relied on, is put to prove the negative, and to show that the bargain is not unconscionable.

Now we are not, save for one purpose which will presently appear, called upon to specify the various kinds of fraud which are held to vitiate dealings in reversions. It is enough to state generally that there must remain after the conclusion of the business a clear record showing that the most scrupulous fairness has characterized the entire conduct of it; that not the slightest advantage has been taken of the ignorance, weakness, or position of the lender. It cannot be too firmly impressed upon the advisers of the latter, that in every step of the negotiation those rules which guide men of business in such matters should be most carefully observed; for it is not too much to say that any uncommon feature would be seized upon by the Court as an indication of fraud, however innocent the transaction might otherwise be. Safety is best assured by following the ordinary lines. Intricacy of details in the security taken might well be assumed to be beyond the comprehension of the favoured borrower. And here it might be observed that such a precaution as procuring a written declaration from the reversioner that he well understands the transaction, is one of those marks of excessive caution which are far from finding favour in a judge's eyes. Unless such declaration is the result of an explanation by an independent and competent adviser, it manifestly carries the case no further than the point at which it stood when the deed was signed—the same presumed evil influence still reigning supreme over the untutored mind of the borrower.

What then are the safeguards which insurance offices and others lending money upon reversions should provide in order to be ready at any subsequent time to defend their title, and what are the pitfalls which they must seek to avoid? As the result of a careful examination of the decided cases, we think that these questions admit of a general answer in the sense which has been already referred to: that is to say, that there must be consummate honesty and fairness on the one side, and perfect understanding and opportunity of knowledge on the other. This guide is, however, too vague to be of practical use. To indicate more specifically the elements of which the doctrine is composed, let us endeavour to take a concrete example. A applies to B for a loan. The security offered is an

absolute interest in land expectant upon the decease of A's father, aged sixty-five years. A distinctly refuses to allow any application to be made to the family solicitor, or any communication to his father. Now what is the proper course for B to follow? Should he reject the proposal? or if he entertain it, how can he safely carry it into effect with the fear of a Court of Equity before his eyes? We assume that the title is quite simple; for instance, that it arises under the will of A's grandfather, which can be seen at Somerset House. We will avoid any question as to notice to trustees by supposing the estates under the will to be legal estates to the use of the father for life, with remainder to the use of A in fee-simple. In the first place B has to satisfy himself of the value of the property, and then of the value of A's interest in it. This he does by obtaining a report from a local surveyor, and another from an eminent actuary. Bearing in mind that the Courts have now arrived at the principle that the market value, and not the actuarial value, is the guide in such cases, B lends the money, having first recommended A to appoint a separate and independent solicitor. If the mortgage deed is in the ordinary form no question can possibly arise upon such a transaction. But suppose B to insist upon an insurance of A's life, which in such a case is clearly unnecessary unless the value of the property is not certain to cover the whole risk, that would be a badge of fraud. In some recent cases the lender has not only taken this questionable precaution, but has added the premium —a single one—to the principal, and then introduced into the deed a provision that in any event the policy should belong to him. Such a thing would have no chance of being supported. In one case the money was advanced in consideration of annuities payable until the borrower came into possession. It was not tried out, but it was argued that the circumstances showed a gross advantage taken by reason of the insertion of such a provision as to the policies, and also that the policies, instead of being effected on the joint lives of the tenant for life and the borrower, were made upon the life of the borrower alone. There can hardly be a doubt that this scheme would be condemned by any Court before which the facts actually came for adjudication. At the same time it must be borne in mind that borrowers, who have only reversionary interests to offer by way of security, must expect that onerous terms will be imposed upon them, for they are, of course, liable to have compound interest for a limited time computed against them in ascertaining the margin of security to the lender.

But it is this, amongst the other matters to which we have already alluded, which constitutes one of the claims of the borrower to protection from the Courts. To return to our example. Obviously if the borrower represents and believes his father's life to be an average one, and without inquiry B assumes that fact, it would be difficult to attack him on that point if the truth were that the life was by no means of such a character. But if it could be proved that by any means he had notice that the life was in danger from a disease not known to A, that would be a strong circumstance against him. It is prudent, therefore, for B to make some judicious inquiry on this head; for the question whether he had notice or not of a danger to the life is one which involves some great risks in a Court of Equity, where notice is often presumed from small outlying matters, not to speak of its presumption from the absence of inquiry alone. One further point it is of great importance to remember, namely, that the application of the doctrine of fairness is not necessarily affected by the age of the borrower. If A were a young man of 22 years of age, fresh from the University or still at College no doubt that alone would make the burden heavier upon B to show his strict *bona fides*. But many cases could be cited from the law reports of relief being granted to persons of far more advanced age, and some are extant in which persons 36 and 39 years old respectively successfully impugned their own acts on some of the grounds we have enumerated.*

When independent advice is spoken of as a safeguard to the lender it must be carefully considered whether the person giving such advice is really, and not only apparently, independent of the lender. The independence must be absolute. The adviser must be a man competent to explain the affair, and so unconnected with the lender that he does his duty without fear or favour. The fact that such advice has been given should be preserved as a stay of the lender's title, and he may properly insist upon having a statutory declaration by the adviser setting forth the course he took in the business in relation to his client.

Having now pointed out the leading dangers of, and the precautions to be taken in, advancing money to expectants, let us pass on to the position of a person who takes a transfer of the security from the original lender. It often happens that the individual to whom the application is first made is not really a man of substance,

* Bromley *v.* Smith, 26 Beavan's Reports, 644; and Earl Portmore *v.* Taylor, 4 Simon's Reports, 182.

but in reality a mere agent or money-lender who, after catching a customer by means of a plausible advertisement, lends his name, or the name of a friend or partner, to more wealthy persons who really advance the money. It is not too much to say that this class of loan-mongers are not over-scrupulous in their mode of conducting their business. They have not always much to lose, and they are willing to run great risks on the chance of securing large profits in the majority of cases, out of which they may be able to pay damages in a few when the fear of publicity does not deter their victims from litigation. These persons are very careful, however, to secure themselves and those behind them by documents which, at first sight, are models of straightforward drafting, in form complying with every requirement of the law, and usually supported by other documents intended to show the entirely business-like character of their dealings with their borrowers. As very often happens, the gentlemen who apply to them in the first instance ask for a very small sum, and little difficulty is made in obtaining it. But the descent to the Avernus of debt is exceptionally rapid and easy, so that far larger sums are soon wanted. Then comes the question of how they are to be obtained by the accommodating lender. He has them not, so he applies to some other person or company to take a transfer of the securities he holds, and to make a further advance. Now what should such a transferee do to protect himself? Broadly stated, we have no hesitation in saying that he must do all those things which as a prudent man he would have done had the reversion been first proposed to him as a security. In technical language he is fixed with all the equities to which the transferor himself was subject at the time of the transfer; and amongst those equities is the liability at any time to be ready to prove the fairness of the original transaction. He should take nothing upon trust, nothing upon verbal assurance, nothing upon calculations or valuations previously made without satisfying himself of the accuracy of every statement, of the soundness of every calculation or valuation. The whole matter should be treated *ab ovo*. Moreover, the form and nature of it as exemplified by the deeds evidencing the loan should be carefully considered by his advisers. In short, he should neglect nothing which he himself would have done had he been himself the lender in the first instance. If he does, and the whole matter is subsequently impeached, he will find himself joined as a principal defendant to support transactions which may have been grossly fraudulent, and such as the mere fact of his connection

with them might greatly damage his reputation as a man of honour, not to mention the loss of a great part of the advantage he contemplated at the time when he made the advance. It sometimes happens that after several independent loans by the same person to the same expectant, after a transfer such as we have referred to, it is proposed that the loans should be consolidated, that is, that the instruments securing the previous advances should be annulled, and that a new instrument should be prepared covering the whole range of the past dealings. As a matter of convenience and simplicity there is no objection to this course, and if nothing is to be inferred from it, it would hardly have been necessary to mention it in this place. But in several cases where mortgages of reversions have been impeached, this fact of a consolidation has been relied on for the purpose of showing a confirmation of everything that preceded it by the borrower: a kind of persistency in a course from which express approval is to be presumed. This view has ever been held by the Courts to be fallacious. A transaction free from blot or concealment requires no confirmation to uphold it; one which is impeachable is none the less so, because under unaltered circumstances it is repeated or affirmed. On the contrary, in the language of a famous judge, such an attempt at a confirmation "does but double-hatch the cheat." Without something more, then, this device of consolidation carries the case no further.

But confirmation may take place if at the date of it fresh advice has been taken, and when, with full knowledge of the vice of the original transaction confirmed, the mortgagor is still willing to stand by it. He may do this by any act or conduct of his, or by his will. In that case the security will become thenceforth unattackable by him or his representatives. He may also confirm it by long acquiescence if he can be shown to have been long cognizant of his right to relief; and when his demand has become stale, the Court thinks it only fair to bar him of a remedy the easier to be obtained, because the burden of proof lies upon the other side. As soon as he knows his position, or as soon as the distress or influence under which he laboured is removed, he must do one thing or the other, he must be held to confirm or he must seek to set aside the deed executed when he was in ignorance or under duress. In one case, however, from the nature of it a longer time may be allowed. This arises where the *sale* of a reversion is sought to be set aside on the ground of undervalue, and then time will run only from the date when the interest falls into possession. And,

of course, if the original contract was void as against public policy, as in the case of a marriage brocage contract, or the like, it is incapable of confirmation by acquiescence or otherwise;—voidable transactions alone being subject to such subsequent express or implied approval.

The stringency of the doctrine which we have sought to explain would lead us to suppose, and we shall not be mistaken in the supposition, that the nature of the relief granted is extremely favourable to the borrower. The Courts have uniformly held that the repeal of the Usury Laws does not prevent them from cutting down the agreed rate of interest to the rate of 5 per-cent, being the rate of interest which the Court supposes a commercial man is able to make with his money: and the usual decree directs the borrower to repay the amount actually received, with interest at that rate only. The defendant usually receives the costs of the action to set aside the security, unless he has refused a sufficient sum before litigation; and he is allowed any money expended by him in lasting improvements on the property if he has been in actual possession of it.

In conclusion of this necessarily imperfect sketch of a very important branch of the law, and as an apology for that imperfection, it should be observed that the cases, in which the principles we have attempted to bring together are laid down, are as various in their circumstances as might be expected from the growing ingenuity of man in striving to obtain an advantage from his weaker fellow. It is therefore impossible to regard all the small incidents which on one side or the other have been held to affect the general doctrine. Broadly, it may be said, that in no case where a lender upon a reversionary interest of any kind is able to show that in all things he himself acted uprightly and openly, persuading nothing, concealing nothing, confident that it was not under his pressure that the borrower made the security, and that he did so with his eyes fully open to the effect of it, the transaction will be upheld just as every other fair bargain between man and man is recognized and supported by the Courts of the country.

CORRESPONDENCE.

ERRATA IN THE INSTITUTE OF ACTUARIES' TEXT-BOOK—PART I.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—My attention has been called by Mr. D. J. McKenzie to an error in the Table of Values of $\text{Log}_{10}(1+i)$ to 15 places, given on page 166 of the *Institute of Actuaries' Text-Book*, part I. The error is as follows:—

With argument $100i = \frac{9}{16}$, the tabular result $\log_{10}(1+i)$ is given as ·002 336 061 443 105, whereas it should be ·002 436 061 443 105, the figure 3 being wrongly given in the fourth decimal place instead of the figure 4.

The table in question was, as will be seen on reference to the *Text-Book*, specially computed by my friend Mr. Peter Gray, whose reputation as a computer may be almost described as world-wide, and the conclusion naturally arrived at would be that the error was that of the printer and proof-reader. Curiously enough, however, on turning to the original manuscript table, I found that it was not so, and that the error lay in the table itself as constructed.

I have communicated with Mr. Peter Gray, and have received from him a letter pointing out how the error must have arisen, and as clearly indicating how, with the greatest care and the use of the best methods, errors will creep into calculations, I propose to give an extract from this letter, having received Mr. Gray's permission to do so. He says, after referring to the extreme improbability of the occurrence of two compensating errors in two consecutive additions, "Was not, in fact, the mode of formation the following? First, the "insertion of the differences; secondly, the addition of the same in "groups of ten, the successive sums being terms of the required "series, which sums, or the last of them, at any rate, were verified "by comparison with the parent series. Supposing all this, there "would remain the final additions for the formation of the individual "terms; and verification of the whole would be secured by the "correspondence of each of the previously inserted terms, as it was "reached, with the sum of all the preceding terms. Now $\log(1+i)$ "for $100i = \frac{10}{16}$, is one of these inserted terms, and was therefore "correct to begin with. An error was committed in the formation "for $100i = \frac{9}{16}$; and this was overlooked in consequence of careless "examination." (*See Mr. Gray's note on p.* 167 *of the Text-Book*).

While writing of this table, it will be of interest to give your readers the benefit of Major-General Hannyngton's examination of the table in connection with the doubt expressed by Mr. Peter Gray (*see* p. 168 of the *Text-Book*) as to the accuracy of the last figures in the tabular results. Major-General Hannyngton writes to me as

follows: "I have checked the logarithms of $(1+i)$ by the simple "process of *adding* the log of $\frac{1}{16}$ to those of 1,600, 1,601, &c., in "col. 1 of Gray's 24-*Figure Table*, pp. 26 to 32. In this way all "the terminal figures are easily found true in the 15th place, and "the following list shows where the last figure should be increased by "an unit:

$0\frac{1}{2}$	+	2	+	$4\frac{3}{16}$	+	7	+	8	+
		$\frac{15}{16}$	+	$\frac{7}{16}$	+	$\frac{1}{16}$	+	$\frac{2}{16}$	+
1	+			$\frac{14}{16}$	+	$\frac{2}{16}$	+	$\frac{6}{16}$	+
$\frac{2}{16}$	+	$3\frac{2}{16}$	+			$\frac{3}{16}$	+	$\frac{11}{16}$	+
$\frac{10}{16}$	+	$\frac{4}{16}$	+	$5\frac{2}{16}$	+	$\frac{6}{16}$	+	$\frac{14}{16}$	+
$\frac{12}{16}$	+	$\frac{5}{16}$	+	$\frac{5}{16}$	+	$\frac{7}{16}$	+		
$\frac{13}{16}$	+	$\frac{1}{2}$	+			$\frac{11}{16}$	+	9	+
		$\frac{13}{16}$	+	$6\frac{1}{2}$	+			$\frac{6}{16}$	+

Mr. J. R. Watson, A.I.A., of Glasgow, has pointed out an error in line 9 on page 94, where the words "actually paid by the lender" should read "actually paid by the borrower."

I am, Sir,

Your obedient servant,

1 *September* 1884. W. SUTTON.

JOURNAL

OF THE

INSTITUTE OF ACTUARIES

AND

ASSURANCE MAGAZINE.

Opening Address by the President, THOMAS BOND SPRAGUE, M.A., F.I.A., F.R.S.E.

[Read 24 November 1884.]

GENTLEMEN, since we last met, a most important event has occurred in the history of our Institute. The object at which we have been aiming for more than two years, has at last been happily attained. A Royal Charter has been granted to the Institute of Actuaries, and our profession now takes its proper position before the public, as a united and officially accredited body. As our first president, the venerable Government Actuary, John Finlaison, pointed out at the foundation of the Institute, it is very many years since the profession of an actuary was recognized in Acts of Parliament; but hitherto the public have had no means of ascertaining who was entitled to be called an actuary. This will now no longer be the case; but the rule may be distinctly laid down, that an actuary is a Fellow of the Institute of Actuaries, or a Fellow of the Faculty of Actuaries in Scotland, and that no other person can properly take to himself the title. This would not have been the case, but for the fact that the important section of the profession, which for many years kept aloof from us, have now joined us in a body. This is, in my opinion, an event on

which both the Institute and the Actuaries' Club, are to be congratulated; and I do not doubt that the union thus accomplisht will prove advantageous in various ways to all parties concerned.

By the grant of a Charter, a fundamental change has been made in the character and constitution of the Institute. It is no longer a private scientific society, composed of gentlemen associated together for the purpose of promoting the study of the theory of life insurance; but it is now a professional body, publicly recognized as representing and entitled to speak in the name of, the actuaries of the United Kingdom. It is impossible at present to say exactly what duties will devolve upon it in consequence of this change in its constitution—what steps may hereafter be taken, to enable it to protect the public from being preyed upon by unqualified men professing to be actuaries, or to exercise discipline over members of the profession. I am sure, however, I shall have the sympathy of all the members, when I express the hope that, whatever new duties may devolve upon the Institute, these will be found to be not inconsistent with the continued discharge of the useful functions with which its name has been so long connected.

In my address to you two years ago I gave a sketch of the past history of the Institute, and last year I made some remarks on the present status and present position of the professional Actuary. Having thus dealt with the past and the present, the idea naturally suggests itself that I should now deal with the future, and speculate as to the probable future of the Institute and of the actuarial profession. This, however, is a subject which, for various reasons, I will not venture upon. In order to treat it at all satisfactorily, it would be necessary to obtain much information as to the history of other professions which, like our own, have gradually increast in numbers and importance, until they have obtained public recognition. If it were practicable to obtain full information of this kind, and to trace the effect that such recognition has had upon various professions, a conjecture might be hazarded as to its probable effect upon the actuarial profession; but the necessary information is not at my disposal. There is a further reason why I prefer to abstain from any such speculations as those above mentioned, namely, that any public expression of opinion as to the probable future of the Institute, might inconveniently hamper the deliberations of the committee which has been charged with the preparation of the new bye-laws. I therefore purpose this evening to take up a more practical subject—to

say something as to the recent progress of the business of Life Insurance—and to lay before you a few general reflections, suggested by my own observation and experience during the period of nearly thirty years for which I have been connected with it. I will not go back to the early history of life insurance, for this reason, among others, that the subject is very fully treated in the essay to which has been awarded the first Samuel Brown Prize, and which, I am pleased to say, is intended to be read at one of our sessional meetings; but I think that a slight sketch of the progress of the business in our own times, may be both useful and interesting.

A convenient starting point is furnisht by Babbage's work, published in 1826, and entitled *A Comparative View of the Various Institutions for the Assurance of Lives.* This work gives certain particulars regarding 32 life insurance offices; but it is remarkable how little real information it contains regarding their finances. The information on such a simple matter as the nominal capital and the amount paid up in the case of the proprietory companies, is very incomplete; and even as regards the proportion of the profit given to the assured, Babbage is obliged to admit that, in no less than eight cases, this is unknown to him. We look in vain through the book for any information of the kind we are now accustomed to see, as to the total sums assured, the premium income, and the accumulated funds. It may be mentioned in passing, that, of the 32 companies mentioned by Babbage, 11 have since ceast to exist. Seventeen years later, in 1843, David Jones, in his work *On Annuities and Reversionary Payments,* gave a short account of the London life insurance offices, which, according to him, were 74 in number. In certain cases he states the amounts of the bonuses that had been declared,—a kind of information that is almost entirely absent in Babbage's work, although this contains chapters on the proportion of profits returned to the assured, and on the periods of division; but Jones, like Babbage, gives little or no information as to the finances of the companies. At this time, the life offices were under no obligation to publish their accounts; and several of the oldest and most respectable of them, never publisht any figures whatever. It was therefore impossible for any person outside an office to know the extent of its transactions, the magnitude of its funds, or the principles upon which its periodical investigations were conducted,—in fact, to know whether it was solvent or insolvent. This is no mere theoretical opinion; for instances might, if necessary, be

given, of companies which continued to stand high in public estimation, for years after they had been brought into difficulties, or to positive insolvency, through mismanagement; in fact, there was literally no means of distinguishing between the well-managed and the mismanaged offices. Babbage, in his work already mentioned, thinks it worthy of special mention that one of the offices existing in his time, had a regulation that the whole of the accounts were to be regularly audited upon an improved and most efficient plan, and the results thereof, without any reservation, submitted to a general meeting annually, or oftener if required. He adds—"This deserves imitation; and, if rigidly adhered to, is the best security any society can offer to the public." It is to be noted that Babbage makes no mention of the Scotch offices, some of which had been in operation for a considerable number of years at the time his book was written; the reason presumably being that they had not at that time opened branch offices in London. David Jones, on the contrary, includes in his list almost all the Scotch offices existing in his time, the exceptions evidently being those which had not extended their operations to England. We thus learn approximately the date at which the Scotch offices invaded England, with the result that they are now very firmly establisht, and perhaps transact a very much larger business there, than in their native country.

Coming down a few years later, we have two lists of offices prepared by the late Mr. Samuel Brown, and printed in the second and sixth volumes of the *Assurance Magazine*, which was afterwards, and still is, called the *Journal of the Institute of Actuaries*. The former of these relates to the business of the offices in the years 1849-50-51. It contains the names of 158 offices; but for 84, or rather more than half of these, no figures are given as to the amount of business. Of the remaining 74, 31 give particulars of the new business, 7 of the accumulated funds, and 36 of both. The latter table relates to the years 1852-53-54. It contains the names of 224 offices, but for exactly half of these no figures as to the amount of business are given. Of the others, 42 give particulars of the new business, 14 of the accumulated funds, and 56 of both. It must not be supposed that the above numbers, 158 and 224, indicate the number of offices existing simultaneously during the periods to which the lists relate. The actual number of companies that existed at the same time, is rather less, in consequence of each list containing the names, both of the offices that passed out of existence and of the new ones that commenced

operations, during the three years to which it relates. The information Mr. Brown was able to obtain, was very incomplete; and he states that many of the figures he has given, are approximations that he has got by various processes. In consequence of this imperfection of his materials, he abstained from making any summary of the facts; but the tables are nevertheless of great historical interest, and a careful study of them leads to several very interesting conclusions. The first thing that strikes us in looking through them, is the immense number of offices contained in them which have since disappeared. Of the 158 contained in the former list, no less than 91 have ceast to exist; and 148 of the 224 in the second list. Another point which appears very clearly from the tables, is that the business of individual companies 30 years ago, was much smaller than at present, both as regards invested funds and new assurances.

In other words, life insurance companies have participated in the general movement of modern times, in the direction of concentration and consolidation. We see this tendency in all directions around us, not only in commercial undertakings, both private and public, such as railway, gas, telegraph, and banking companies, which are continually becoming larger by the absorption of their rivals; but on a still larger scale in the growth of nations, although the details of the process may be different in nearly every case. It will suffice to mention Italy, Germany, Russia, the United States, and our own Colonial Empire. It is impossible to predict how far this process will be carried, but there is no reason to expect any change in the tendency, so long as modern science continues to provide us with increast facilities of communication. On the contrary, there is every reason to believe that, by the completion of the railway system in countries to which it has not yet been extended, and by the building of more powerful and swifter steamships, the time occupied in travel between distant countries will be greatly reduced; and it is impossible to say what progress in the way of rapid communication may be made in the future, by the aid of the telegraph and the telephone. The recent introduction of the latter into large cities, is effecting an immense saving of valuable time, and bids fair to revolutionize in some respects the mode of transacting business; and it seems quite within the bounds of possibility that in a few years' time a person in London may be able to carry on a conversation, by means of the telephone, with a business correspondent in New Zealand or Australia, as easily as two

persons resident in different parts of London can now converse by its means.

Whether the total business transacted by all the offices has increast since the date of Mr. Brown's tables, is quite another matter. There were then about twice as many companies as there are now; but, unfortunately, there is no means of saying with certainty whether the total business transacted by the companies then, was as much as that transacted by the smaller number of companies now. I am inclined, however, to think it was much less. In the former of Mr. Brown's tables, there were 11 companies whose new premiums exceeded £10,000 a year; and in the second, 18 such companies. I need not remind you that at the present time there are a good many more companies whose new premiums exceed this amount. As regards the total amount of funds, there can, I think, be no similar doubt. I find that in the former of his tables there were only 6 companies, and in the second 10 companies, whose invested funds exceeded £1,000,000. At the present time there are, I believe, about 50 such companies; and we may, I think, be satisfied that the amount of the funds of the life offices has been steadily increasing since 1850, as it is still increasing. Another point which appears very clearly from a study of Mr. Brown's tables, is that the companies which made the best show in his time, do not, as a rule, now stand the highest in the list. It would be a very interesting study to trace the ups and downs of individual companies; and I hope that this task, which would be quite unsuitable on the present occasion, will be taken up hereafter by some other person. Mr. Brown infers from an examination of the figures in his two tables, that the total business of life insurance had increast much more rapidly in the three years 1852-54 than in the three years 1849-51, the rate of increase in the later period being nearly double what it had been in the earlier. But this was only a conclusion based upon the figures of 14 companies in the former period and 36 companies in the latter; and it is obviously a very uncertain conclusion. We have no information as to the new business transacted by about half the companies enumerated by Mr. Brown; and probably the new business transacted by several of them was falling off, so that, if figures had been got for all the companies, the rate of increase would have been less. Similar remarks hold good at the present day. While companies are now required to publish very full particulars as to their income, expenditure, and assets, they are not required to state the amount of their new

business; and although most companies give prominence in their annual reports to the amount of new business they transact, still there are several which say nothing whatever on the subject.

It was in the year 1856 that I joined the Institute by the advice of my professional master, the late Mr. Jellicoe, who was for so many years the moving spirit of the Institute and afterwards became its second President. The *Post Magazine Almanack* for that year, contains the names of 196 offices, against 167 in 1853. Thus far we have seen a continuous increase in the number of offices; but about this time the number began to get less, and there has been a steady decrease in the number down to the present time, when 110 offices make returns to the Board of Trade. A large number of new offices had started into existence after the passing of the Joint Stock Companies Act of 1844; and for some years there was an objectionable distinction between the so-called Old Companies, that were in existence before the passing of that Act, and those founded under it, which were called New Companies. I am glad to be able to say that this distinction has long been a thing of the past. All the companies founded under the Act of 1844, were compelled to register accounts; but no form of accounts was prescribed, and the statements of accounts furnished were often of a very unsatisfactory character. This was the more to be regretted because, unfortunately, most of these new companies were extravagantly managed; so much so that after a time it became apparent that they could not be carried on profitably. Thereupon commenced an era of amalgamations.

Against properly conducted amalgamations no reasonable objection can be made. When a life assurance office finds itself, from any cause, unable to continue its business to advantage, the most satisfactory course for all parties is, that some other similar institution should undertake all the risks, on receiving a proper equivalent; and I believe that many amalgamations have been carried through in this way, to the advantage of all persons interested. Most of the amalgamations, however, were not of such a character. It was too often the case that, when an amalgamation took place, or the business of one life office was transferred to another, the funds, which were already far too small to provide properly for the liabilities, were reduced by large payments to professional amalgamators or go-betweens; so that the company which undertook the risks, received an altogether inadequate consideration. Unless we are to suppose that all these amalgamations were distinctly dishonest transactions, we can only imagine

that the persons engaged in them, were dazzled with the idea of largely increasing at a single step the business and the importance of their offices, and did not stop to count the cost. It is unquestionably true that it is more profitable to do business wholesale than retail, and that some allowance may properly be made for the introduction of a large mass of business which would, in the ordinary course, take several years and the expenditure of a large sum of money to secure; but in the transactions we are considering far too much weight appears to have been attached to this consideration. As I have already intimated, I do not wish to include in one sweeping condemnation all the amalgamations that took place about the time we are now considering; but my impression is that, even in those which were carried through in the most legitimate manner, and with the greatest regard to the interests of the policyholders, there was too much of the haste to be rich, that was denounced so long ago by Solomon.

It was not many years before the inevitable result followed. Two companies, whose names are now notorious, the *Albert* and the *European,* distinguisht themselves beyond all others, by the reckless manner in which they absorbed the business of numerous smaller offices. In this way they largely increast their business, but at the same time they still more largely increast their liabilities, and at last in different ways they were formally declared insolvent. The *Albert* one day closed its doors and suspended payment, in consequence of its ready money and its credit being both exhausted. The *European* went on for some time longer, and a petition to wind it up was dismist in consequence of the absence of strict proof that the office was insolvent. A little later, however, the necessary proof was supplied by the publication of a valuation report made by their consulting actuary; and the company was ordered to be wound up. In the winding up of the two offices, the questions that arose in consequence of the many amalgamations that had taken place, were so complicated and difficult, that the ordinary courts of law were found unequal to deal with them; and it was necessary to appoint for each office an arbitrator with special powers to decide all questions that arose. By this means, the affairs of both offices were at last wound up; heavy calls were made on the shareholders of the two companies and of many of the companies absorbed by them; and, after the deduction of enormous law costs, the remaining assets were divided among the policyholders, in the form of a dividend upon the estimated values

of their respective policies. Every actuary must, I think, regard proceedings of this kind with a feeling of sorrow. It is melancholy to see thousands of life policies, that have been taken out in most cases as a provision for old age or for surviving relatives, compulsorily terminated; the holders of them being, in fact, compelled to receive a small surrender value calculated without regard to their state of health. It seems self-evident that it would be more in accordance with the spirit of the contracts they had entered into, that, instead of a division being made of the surplus assets after payment of expenses, these should form the nucleus of a new insurance fund; and that the amounts of the policies should be equitably reduced, to such an extent as may be necessary to make the fund solvent. In no other way can anything approaching to justice be done, as between the holders of policies on lives that continue in good health, and the holders of policies on lives which have, in technical language, become damaged, that is to say, have fallen into bad health. Attempts were made to get this principle acted upon in the case of the *Albert* and the *European*, but without success. It has, however, happily been acted upon in the case of another office which has more recently been declared insolvent—the *Great Britain*. The Act of 1870, of which I shall have more to say presently, authorized, in certain cases, an equitable reduction of the contracts of an insolvent life office, instead of a compulsory division of assets; and in the winding-up of the *Great Britain*, a scheme of this sort was sanctioned by the Court of Chancery, and has now been in operation for some years, apparently with satisfaction both to the policyholders and to the company which has undertaken the administration of their funds.

The failure of the *Albert* Office directed public attention to the necessity for special legislation with regard to the life offices of the country; and in the year 1870 the Life Assurance Companies Act was passed with the general consent of all parties. By this Act various new principles were introduced, the most important being that every institution transacting life insurance business within the United Kingdom, shall annually publish its accounts in a prescribed form; and the returns that have now been made under the Act for thirteen years, have thrown much light upon the operations and positions of the life offices, greatly to the advantage, as I believe, both of the offices themselves and of the public. There has been much more legislation on the subject of life insurance in the United States of America than

in this country, and legislation there has proceeded upon very different lines. It is a characteristic feature of British legislation on the subject, that, while a public department has been charged with the duty of seeing that all the offices transacting business make certain periodical returns, it has not been authorized to pronounce any opinion upon the financial condition of the companies. By our law the companies are required to furnish certain information, which could not be obtained from them by the unaided efforts of their policyholders; and, this information having been furnisht, the persons interested are left to form their own judgment and act upon it, as they may think best. In America legislation has been of a much more paternal character. There the State official not only requires returns to be made by the companies, of a more minute character than is required here; but, when he has got the returns, it is his duty to calculate the liability of each company under its policies, according to a fixed standard laid down by law, and to report whether he finds that the company has assets equal to its liabilities. If not, the company is either required to discontinue granting new policies or is wound up. He not only publishes much of the information furnisht him by the offices, but also his opinion as to their solvency and the amount of the surplus or deficiency that their accounts show. In some of the States paternal supervision of the life offices is carried still further, and they are required to invest exclusively in certain specified classes of securities. So strict is the supervision exercised in America over the life offices, that it was claimed by many persons that the public were effectually protected from the possibility of loss by the failure of a life office to meet its engagements; but experience has proved that this was not the case, and a considerable number of companies in America have been found insolvent and have been wound up.

Having regard to these facts, it would be most interesting and instructive to obtain a complete history of life insurance in the United States, and compare the progress of the business and of the companies in that country and in our own. Perhaps the gentleman who has taken so much pains to write the history of life insurance in this country, in response to the invitation of the Council contained in the circular offering the Samuel Brown Prizes for public competition, will now undertake this further work, for which his many American connections give him special qualifications. In Canada, legislation has very much followed the lead of the United States, but in Australia the Acts that have been past are generally framed upon the English model.

I think I may say, without fear of contradiction, that general satisfaction is felt with the working of the British Life Assurance Acts, and that neither the offices nor the public desire the introduction of a more paternal system of legislation upon the American model. I do not mean to imply that the Act of 1870 is believed to be perfect; but all the suggestions that have been made for its amendment, deal only with minor points of detail, and not with its general principles. It would, for example, be a distinct improvement if the premiums in the Revenue Account were, as is required by the Australian Acts, divided into new premiums and renewal premiums; also if the companies were required to give particulars of the names and amounts of the various stocks and shares they hold as investments. These are comparatively small matters; but suggestions of more importance have been made with regard to the particulars of the policies furnisht under the 5th and 6th schedules. These particulars are not sufficient to enable an actuary in all cases to arrive at a perfectly definite opinion as to the financial position of the company. He can find the value of the sums assured, and the value of the office premiums payable; but he has no means of determining accurately what amount of loading should be taken off from the value of the office premiums. If too large a loading is taken off, injustice is done to the company; the amount of the reserve being unduly increast and a portion of the legitimate surplus withheld from the persons properly entitled to it. If, on the contrary, too small a loading is taken off, the effect will generally be that many policies will have negative values, or, at all events, values much smaller than the sums that the company is bound, by contract or by custom, to pay as surrender values. In any future amendment of the Act, I think this is the most important point that would have to be considered. The companies might properly be required to return to the Board of Trade, the same full particulars of every policy on their books that the American offices are compelled to return, not to one department only, but to the Insurance Department of each of the States in which they do business. The bulk of such additional returns would, of course, be too large to allow of their being printed in the Blue Book like the present returns: but any person interested in the company should have a right to obtain a copy, upon payment of a moderate fee; and he would then be able to put his own estimate upon the liability of the company, without any of the uncertainty above mentioned.

This is, I think, a matter of some practical importance. In the cases of the *European* and the *Great Britain* we have seen the question argued in Court whether the company was insolvent or not; and, in consequence of the lack of information of the above kind, the arguments for and against the companies, were of a very unsatisfactory and inconclusive character; so that, in fact, it was not practicable to wind up the companies until their position had become so desperate, that even their own directors and officials were forced to confess to insolvency. It seems desirable that, when a company is hopelessly insolvent, an immediate stop should be put to its operations;—that it should not be allowed to carry on its business in the usual way, to receive premiums and to pay its claims in full. The funds being by supposition insufficient to provide for payment in full of all claims as they arise, it is not right that the claimants under policies which mature early, should be paid in full, to the detriment of the holders of the remaining policies. In order to secure this, it would not, I think, be necessary that any legal standard of solvency should be enacted; but any question as to the solvency or insolvency of a life office, might be safely left, as at present, to the decision of the Court, after hearing the evidence of actuaries for and against the company: the difference being that, at present, such evidence must to a very great extent be a mere matter of opinion: whereas, in the case supposed, if it were based upon facts accessible to the Court and both parties, the evidence would partake more of the nature of matter of fact. I am inclined to think, also, that something more might properly be required from the companies. At present a company is not only allowed to value its liabilities upon any basis it thinks fit, but to state its liabilities in the gross for each class of insurances, without giving any sufficient indication as to the amount of the reserve made in respect of individual policies. It would be reasonable, I think, that the offices should be required to put a value upon each policy, and include in their returns the amount of reserve made in respect of every individual policy on their books. If this were thought too strong a measure, they might be required to state the values that they put upon certain specimen policies. Either of these methods would give an indication, more or less exact, of the extent to which negative policy-values had been taken credit for in the valuation.

To sum up what I have said, the leading feature of the Act of 1870 was to insist upon publicity being given to certain particulars; and any amendment should certainly be in the

direction of requiring still greater publicity. It is a fair question for discussion whether further publicity might not advantageously be required in some other matters, whether, for instance, it would not on the whole be better if, as in America, every man were taxt according to his income, and the amount of the income and of the tax were generally known. The greater publicity as to the proceedings of the life offices that has been enforced by the Life Assurance Companies Act, has, I believe, had the effect of greatly increasing the confidence of the public, and has thus, of course, been very advantageous to the offices. It has also had various indirect effects, among which may, I believe, be included the very markt tendency in recent years, to a strengthening of the reserves made by the offices. The use of tables which require a small reserve has been discontinued, and the valuations are now generally made by the H^M and $H^{M(5)}$ Tables, or by other tables which require a strong reserve. At one period in the history of the life offices there was a rivalry which should declare the largest rate of bonus; and when the offices were not required to give minute particulars as to the methods of valuation they had adopted, the managers sometimes yielded to a temptation to stretch a point, in order to give a somewhat larger bonus than a rival office. There is very little temptation to adopt a course of this kind nowadays, and I think all will agree that this is a decided change for the better.

The Act was partly intended to check the practice of amalgamations which, as already mentioned, was so very prevalent shortly before its passage; and I believe that it has had considerable effect, both in reducing the number of amalgamations, and in securing that those which have since taken place, have been of a more healthy character, and carried out with greater regard to the interests of the policyholders. The Act was also intended to discourage the formation of new life offices, and its effect in this direction has been most markt. New companies are now required to deposit £20,000 in the Bank of England before they can commence operations, and experience seems to show that this is a sum which is quite large enough to prevent the formation of mushroom companies, but not sufficient to place any material obstacle in the way of a new proprietory company promoted by persons of influence. It will, of course, have a greater effect in discouraging the formation of new mutual offices; but perhaps some of us may have our own reasons for thinking that there are sufficient mutual offices already in existence.

As already mentioned, the number of life offices is much less than formerly, and is still diminishing. It is an open question whether it is for the public benefit that the life insurance business of the country should be absorbed by a few large companies. I am inclined to think that, provided the number of offices is sufficient to give the public the full benefit of competition between different offices, it is a matter of comparative indifference to them whether the number be larger or smaller. If the companies are very numerous, the expense of conducting the business will necessarily be unduly increast; but it has been contended, with some show of reason, that the concentration of very large amounts of business in the hands of a few offices, does not tend to economy of management, but rather the contrary. Let us consider next how the question affects actuaries. If there is a large number of companies, there will, of course, be a correspondingly large number of appointments for which actuaries would be required. If the number of offices is considerably reduced, it seems that the number of actuaries must be reduced too; and I think it would be distinctly disadvantageous for the public if the profession became restricted to a very small number. But a large office transacting a varied business must, for the proper conduct of its business, have upon its staff several qualified actuaries, so that a compensation takes place. Similarly, if, in consequence of a reduction in the number of life insurance companies, a smaller number of managers of offices should be required, there would be found a compensation in another direction. Every very large office, for instance, will have branch offices establisht in all the important centres of population, each under the charge of a district secretary, who will have considerable responsibility; and I am inclined to think it will be found that the position of branch secretary affords a very excellent training for a manager. It is, I think, advantageous for the public that a considerable variety should exist among the life insurance companies, that some should be mutual, other proprietory; some large, others smaller; some cultivating a particular class of business, or deriving most of their policies from a particular class of persons; some dividing their profits in one way, some in another. While such a variety of constitution and practice exists, many questions of principle will be constantly coming up for discussion from time to time, with beneficial results both to the offices and to the assured.

It is often said that the competition between insurance companies is greater now than it ever was before, and is yearly

becoming greater. I am inclined to doubt these statements, and to believe that those who make them have had the competition brought more prominently under their notice, in consequence of some new form that it has taken; for change is always going on in the form of competition, as in everything else. I believe that similar remarks as to the increase of competition have always been made, and I believe they always will be made, and always by persons who feel the competition most, in consequence of their inability to adapt themselves readily to altered circumstances. As regards the future of our business, I am inclined to think that we shall see for some years to come the same sort of progress as we have seen during recent years. Some large companies will grow still larger. Other companies, which for various reasons are left behind in the race, and find themselves out of harmony with the times, will retire from business, each of them handing over its assets and liabilities to some more vigorous rival. Their places will, however, to some extent be supplied by new companies, which will start under the guidance of young men; and these new companies will sometimes achieve a substantial success, in other cases will give up the struggle for existence after a short life. Some offices will find their profits gradually dwindling, in consequence of the falling-off in the rate of interest in the securities in which they principally invest; while others, by taking advantage of the various new openings for the investment of capital, will be able to maintain, and perhaps even to increase, their average rate of interest. The result in each case will depend very much on the qualities and character of the manager of the office; and, without enlarging on this point, I may say that the one conclusion which my experience has impressed on me most forcibly, is that the prosperity of a life office depends principally on the character of its chief officer; and that, if he is unequal to his work, directors, agents, shareholders, and friends, however influential, will labour in vain to promote the permanent prosperity of the office.

In considering the future of life insurance, there is no more important question than the rate of interest; and probably there is no question upon which greater differences of opinion exist, some authorities holding that the rate of interest must inevitably fall, while others take a more sanguine view, and think that so many new openings will continually be found for the safe investment of capital, that the average rate of interest may for long be maintained at its present figure, at all events by those investors

who are prepared to examine dispassionately the various new securities brought under their notice. Looking back for the last 25 or 30 years, we have seen a great variety of excellent securities come into existence, which have yielded a very satisfactory return to those who were the first to perceive their real value and invest in them shortly after their issue. Among these it will be sufficient to specify the guaranteed stocks of the Indian railways and the debenture stocks of the great British railways. The former of these were issued at a price to pay 5 per-cent to the investor, and the latter pay a trifle over 4 per-cent; but both have been steadily rising in public favour, and the original holders, who have for many years received a very satisfactory rate of interest on their investments, could now realize a handsome profit by selling the stocks.

There is no doubt that the rate of interest yielded by consols and other first-class securities has been steadily falling for many years. Mr. Babbage tells us that, with the view of getting an approximation to the average rate of interest in the country, he examined a period of 92 years of peace and war, commencing in 1731 and terminating in 1822. Taking the average price of consols during each year, he finds that the average rate of interest they yielded was £4·1 per-cent during 48 years of war, and 3·48 per-cent during 44 years of peace, or 3·78 per-cent throughout. The average rate of interest yielded by consols during the 60 years which have since elapst, has certainly been less, until now it is a trifle under 3 per-cent. But I am not satisfied that this is a trustworthy indication of what has taken place with regard to other good securities. Babbage intimates that it is generally possible, without additional risk, to make rather a higher rate of interest than that which is yielded by the 3 per-cents, and that it seems reasonable to conclude that 4 per-cent is about the rate of interest which an establishment calculated for any considerable duration, may expect to make. He thus proceeds on the supposition that the average rate of interest yielded by consols, will be about $\frac{1}{4}$ (or perhaps $\frac{1}{2}$) per-cent less than that yielded by other good securities. At the present time, the difference is certainly much larger, as is sufficiently proved by the fact that the largest and most prosperous life insurance offices realize a return of from 4 to $4\frac{1}{2}$ per-cent on their total assets, or, say $4\frac{1}{4}$ per-cent on the average. This seems to be good evidence that there is a greater difference now between the average rate of interest yielded by consols and by other good securities, than there was formerly;

and the fact is to be explained by the very great increase that has taken place in the amount of trust funds of various kinds that have to be invested in consols. I therefore do not consider that the permanent increase in the price of consols, and the probability of an early reduction of the rate of interest upon that stock, can be accepted as proofs that the average rate of interest obtained by the life offices is likely to fall. There has also been a considerable reduction in the rate of interest yielded by other good securities suitable for trustees, such as railway debenture stocks and loans to municipal corporations. In these cases the reduction of the rate of interest has been facilitated by the substitution of permanent, or long-dated stock, bearing a fixt rate of interest, in the place of debentures for comparatively short terms of years.

Notwithstanding these undoubted facts, and others of a similar kind, I do not believe that the average rate of interest realized by the insurance offices, will necessarily fail. In fact, I believe that for, say, the next thirty years the present average rate may be maintained by those offices which are ready to move with the times, and consider the intrinsic merits of the various new classes of securities that are from time to time brought under their notice. I believe that at the present time the larger colonies—Australia, New Zealand, Canada—offer a very promising field for the investment of British capital. They are prosperous and growing communities, under the same Crown, and, with trifling exceptions, under the same laws as ourselves; and funds may be invested in them without the feeling of doubt that must always attach to investments in foreign countries. In the newly settled districts, away from the principal centres of population, the rate of interest is extremely high. It would, of course, be unwise for ordinary insurance companies to attempt to lend their money in such districts; but, even in the oldest parts of the colonies, the rate of interest is considerably higher than it is in the United Kingdom, so that borrowers in those districts find it worth while to pay agents in Great Britain to obtain loans for them on first-class security, at rates ranging from 5 to 6 per-cent, payable in London. The number of applications for loans of this kind appears to be decidedly on the increase, and it is my belief that very large sums may be lent in this way with perfect safety. It is, I think, obviously advantageous, both for the home country and the colonies, that British capital should be lent upon good security in the colonies; and, looking at the enormous extent of unoccupied land

that still exists, and which will require very large outlay for its clearing and improvement in order to render it productive, I firmly believe that, for at least a generation, the colonies will be able to absorb in this way as much British capital as can be conveniently supplied. It is, of course, only in the case of large loans that it is worth while for a borrower to make direct application to the home market; and it is not every lender who is willing to take the trouble and responsibility of dealing direct with the borrower at the Antipodes; but a machinery has grown up of late years, by means of which colonial borrowers and home lenders are indirectly brought together. A large business is now transacted by the companies which have been formed for the purpose of borrowing money in Great Britain and lending it at a higher rate in the colonies. They usually have a large capital, of which 20 or 25 per-cent only is paid up, their borrowing powers being limited to the amount of their unpaid capital. Hitherto, I believe, the operations of almost all these companies have proved to be very satisfactory, both to the depositors and to the shareholders; and the number of them seems to be increasing yearly. The terms offered by such companies to depositors vary, according to circumstances, from four to five per-cent, or even more, and I believe that very large sums may be safely invested in their debentures at an average rate of interest of something over 4½ per-cent. Various colonial banks also will take money on deposit for fixed terms of years, at similar rates of interest; and the debentures of colonial municipalities may be purchast to yield 4½ per-cent in the case of the largest cities, and higher rates in the case of smaller places.

I have thus endeavoured to submit to you a few reflections based upon the history of life insurance in recent times; but I feel that my subject has been very imperfectly treated; in fact, that I have done little more than indicate a field of enquiry, that will yield a rich return to any student who shall cultivate it diligently. In order to get the best results, it would be necessary that the history of each office should be traced separately, and with the greatest accuracy attainable,—its rise, its growth to maturity, its decay, and, lastly, its death and burial, or so many of these stages as it has past through. Information should also be collected with regard to any changes of the conditions of insurance, introduction of new features, amount of bonuses declared, and the manner in which these are given; and, lastly, as to the names and previous occupations of the chief officers appointed from time to time. If

such information were complete, most valuable and trustworthy conclusions might be drawn as to the causes which lead to the prosperity or decline of individual life offices; and, by combining the results, we should obtain information as to the progress of life insurance in the country, more trustworthy than it would be possible to obtain in any other way. We might thus learn to avoid the mistakes of our predecessors, and to profit by their experience. The materials for such a history are very plentiful, and would be found in the reports, prospectuses, and advertisements of the companies, and in the original articles and the correspondence in the insurance periodicals. It is no doubt very difficult to write contemporary history with impartiality, but it surely is not impossible; and contemporary history, if so written, must be the most instructive of all history.

I will conclude, then, by expressing the hope that, if some future President of the Institute should wish to make further remarks on my present subject, he may find that such a history of modern life insurance as I have indicated, has been written. Furthermore, since the history cannot be complete until it contains information as to the new business transacted by every office; and since it is a matter of national interest and importance to know whether the practice of life insurance is increasing in the country or not; and since other useful objects may be gained by a revision of the Act of 1870; I venture to throw out the suggestion that steps should be taken to collect the opinion of the profession, as to the working of that Act, and to ask for its amendment in such respects as may, after full consideration, be thought desirable.

Some Account of the Census, from 1801 *to* 1881. *By* Arthur Francis Burridge, F.I.A., F.S.S., *of the Equity and Law Life Assurance Society.*

PRIOR to the commencement of the present century, no direct method had been adopted to ascertain the number of the population in England. Various estimates, founded upon Domesday Books, Subsidy Rolls, and payments of Hearth and Poll taxes furnish, with more or less exactness, the numbers at previous periods. Three such calculations relating to the population towards the close of the 17th century are mentioned by Macaulay as being

entitled to peculiar attention.* "Of these computations one was made in the year 1696 by Gregory King, Lancaster Herald, a political arithmetician of great acuteness and judgment. The basis of his calculations was the number of houses returned in 1690 by the officers who made the last collection of hearth money. The conclusion at which he arrived was that the population of England was nearly five millions and a half. About the same time, King William the Third was desirous to ascertain the comparative strength of the religious sects into which the community was divided. According to the reports laid before him from all the dioceses of the realm, the number of his English subjects must have been about 5,200,000. Lastly, in our own days, Mr. Finlaison, an actuary of eminent skill, subjected the parochial registers to all the tests which the modern improvements in statistical science enabled him to apply. His opinion was, that, at the close of the seventeenth century, the population of England was a little under 5,200,000 souls. . . . We may, therefore, with confidence pronounce that, when James the Second reigned, England contained between five million and five million five hundred thousand inhabitants."

An abstract of the results obtained by Gregory King, of the income and expense of the several families in England, calculated for the year 1688, gives the following results†:

Number of Families, 849,000.
Number of Persons, 5,500,520 (including Vagrants, as gipsies, thieves, beggars, &c., 30,000).
Total Yearly Income, £43,491,800.

When first, in 1753, it was proposed in the House of Commons to register "an account of the total number of marriages, births and deaths, and of the total number of the poor receiving alms in every part of Great Britain", the scheme was received with grave dissatisfaction. "I did not believe"—such was the protestation of one speaker—"I did not believe there was any set of men, or indeed any individual of the human species, so presumptuous and so abandoned as to make the proposal we have just heard; . . . . a project totally subversive of the last remains of English liberty. A register of our people will acquaint our enemies with our weakness." The first enumeration of the population took place nearly half a century later, on the

* *History of England*, vol. i, p. 282, 7th edition, 1850.
† *British Almanac and Companion*, 1835, p. 72.

10th March 1801, when England and Wales was found to contain 8,892,536, and Scotland 1,599,068 inhabitants. The Census of 1801 did not extend to Ireland.

Censuses of 1801, 1811, 1821, and 1831.

The first four enumerations, namely, those of 1801, 1811, 1821, and 1831, were made by the agency of the overseers of the poor; this being the only, or the best, machinery available at those dates for the purpose. The collection of the requisite data could not be obtained in the course of a single day; and, as a Census to be accurate must be taken on a uniform system and simultaneously, there is little doubt that the answers obtained were imperfect and inaccurate.

Censuses of 1841 and 1851.

The enumerations of 1841 and 1851 in England were much facilitated by the uniform system of registration of births, marriages and deaths, which came into operation on 1 July 1837; which not only afforded means of checking the accuracy of the returns, but provided a prompt and skilled machinery accustomed to statistical work. In Scotland it was necessary to employ the parish schoolmasters to perform the duty of enumerating the population in country districts.

In Ireland the first attempt at a Census was made in 1811. It was repeated in 1821; but went no further than a bare enumeration of doubtful accuracy.

The Census of 1851 "exhibited not only statistics of parishes and parliamentary and municipal boroughs, but also of such other large towns in England and Scotland as appeared sufficiently important for separate mention; and of all the ecclesiastical districts and new ecclesiastical parishes which, under the provision of various Acts of Parliament, have, during the last 40 years, been created in England and Wales."* In addition to the enquiry concerning age, occcupation and birthplace, of the population it was determined to ascertain the various Relationships (such as Husband, Wife, Son, Daughter), the Civil Condition (as Married, Unmarried, Widower or Widow), and the number of persons Blind, Deaf, or Dumb. Another novel feature in the Census of 1851 was an attempt to supply the statistics of the ecclesiastical and educational condition of the country. But this was pursued as a purely voluntary investigation.

* *Report of Commissioners of Census of the United Kingdom,* 1851.

Census of 1861.

The local machinery, by means of which the Census in England was taken in the year 1861, differed in no material respect from that employed in 1851. In Scotland, the enumeration was made for the first time apart from that of England. The Registration Act for Scotland took effect from 1 January 1855;* and the Census of 1861 was made under the superintendence of the Registrar-General for Scotland through the agency of 1,001 local registrars assisted by 8,075 enumerators. In 1861 it was ascertained that the islands in Scotland amounted to 787; and of these 186 were inhabited by one or more persons on the Census day.†

Census of 1871.

The Census taken on 3 April 1871 marked a most important extension of the system, since on that occasion, for the first time, an Imperial Census was taken embracing the whole of the British possessions. "In this great undertaking the work was subdivided for convenience of execution:—the United Kingdom among three departments—the Census of the several colonies and of India among their several administrations—under the supreme direction of the Home Secretary, of the Colonial Secretary, of the Lord-Lieutenant of Ireland, of the Governor General, and of the Secretary of State for India."‡

Welsh schedules were issued for a certain number of Welsh people; and in 17,276 cases, representing about 77,742 persons, particulars were inserted in the Welsh language.§

In Ireland the Census of 1871 was taken by the Registrar-General of Ireland, enumeration being made by 4,536 members of Royal Irish Constabulary.

Territorial Sub-divisions of England.—The Poor-Laws Amendment Act (1834), *and The Registration Act* (1836).

The Act for *the Amendment and Better Administration of the Laws relating to the Poor* (4 & 5 Will. IV. cap. 74, s. 26, 1834), empowered the Poor-Law Commissioners to declare so many parishes as they might think fit to be united for the administration

* The Registration Act for Ireland came into operation on 1 January 1864.

† The materials for the foregoing account of the earlier enumerations were derived, for the most part, from the *Encyclopædia Britannica*, 9th edition, article—"Census."

‡ *Registrar-General's Report—Census* 1881, vol. iv, p. 75.

§ *Ibid*, p. 9.

of the laws for the relief of the poor. The united parishes were designated *Unions*.

Registration Act, 1836.

Under the Act for Registering Births, Deaths, and Marriages in England (6 & 7 Will. IV. c. 86, 1836), the *Unions* were made the basis of the registration district, and were subdivided into smaller districts, called sub-districts. The whole of England and Wales had not been placed under the Poor-Law Amendment Act; but the Registration Act extended over all England and Wales. At the period when the Census of 1851 was taken, the number of districts was 624.

Registration Counties.

Under the arrangements consequent on the passing of the Registration Act, no alteration was made in the boundaries of parishes. For the *Hundreds*, Districts were substituted; and the groups of complete districts—called Registration Counties—differed little in extent from the Ancient Counties as left by Acts 2 & 3 Will. IV. c. 64 (1832) and 7 & 8 Vict. c. 61 (1844). Under the latter Act, every detached part of a county in England and Wales became, since 20 Oct. 1844, *for all purposes*, part of the county to which it had been annexed under the Boundary Act. The cause of the discrepancy between the registration counties and counties proper, arose from the circumstance that in many cases the boundaries of the latter were rivers; on which, subsequently, at fords and bridges, important towns arose. These towns, although situated partly in one county and partly in another, were made the centres of the new registration districts.

Changes in Territorial Divisions since 1851.

One of the most important measures was the Metropolis Local Management Act, 18 & 19 Vict. c. 120 (1855). Under this Act, the Metropolitan Board of Works was constituted.

Under the Act for the better management of Highways in England, 25 & 26 Vict. c. 61 (1862), a new set of county divisions was formed, for applying the principle of unions of parishes to highway districts.

In regard to the population of towns, it is necessary clearly to define what limits are referred to; for under the name of the same town may be meant the parish, the township, the parliamentary borough, the registration or poor-law district, or the town in a popular sense including suburban places. For the

purposes of the Census the registration districts are selected, with the principal towns, for the territorial units of which the sexes, ages, conjugal condition, occupations, and birth-places, are separately displayed. The number of registration districts has been altered many times since 1851; in 1871 the number was 626*; and in 1881, 630.

Sanitary Districts.

Since the date of the Census of 1871 (3 April), a very important division of the country has taken place, owing to the formation of Sanitary Districts—urban and rural. The rural sanitary districts, 578 in number, coincide for the most part either with entire registration areas, or with the parts of such areas as remain after subtraction of any urban sanitary district within their limits. The urban sanitary districts number 966.

No. and kinds of Areas in England and Wales.

The areas in England and Wales of which account was taken in the Census of 1881 (4 April) were as follows:

1	England and Wales.
1	England.
1	Wales.
1	North Wales.
1	South Wales.
52	Counties.
95	Parliamentary counties or divisions of counties.
198	Parliamentary boroughs.
243	Municipal boroughs.
752	Wards of municipal boroughs.
830	Hundreds.
715	Petty and special sessional divisions.
616	Lieutenancy sub-divisions.
7	Cinque ports and ancient towns (parent ports).
23	Additional members of Cinque ports and ancient towns.
14,926	Civil parishes.
34	Ecclesiastical provinces and dioceses.
136	Separate constituent parts of such dioceses.
6,958	Ecclesiastical parishes that are neither entire mother parishes nor conterminous with civil parishes.
9,107	Separate constituent parts of such ecclesiastical parishes.
11	Registration divisions.
57	Registration counties.
630	Registration districts.
2,175	Registration sub-districts.
966	Urban sanitary districts.
578	Rural sanitary districts.
184	Various Metropolitan areas not included above.

* *Registrar-General's Report, Census* 1871, vol. iv, p. xxxvii.

I.—The British Empire.

Census of 1881.

Having briefly traced the development of the Census system, from its commencement in 1801, we proceed to notice in detail the results of the Census taken on 4 April 1881, when, for the second time, an enumeration was made of the population of the British Empire. The territory occupied by the inhabitants of the British Empire in 1881, who numbered 254,187,630 persons, is estimated as consisting of slightly over eight millions of English square miles*—an area twice as large as Europe, and not far short of one-sixth of the land surface of the earth.

In 1871 the population was reckoned as 234,802,593†; so that the increase in the decade amounted to 19,385,037.

The following tables, taken from the Registrar-General's reports, give the population, in 1871 and 1881, of the United Kingdom and the Colonies, with their areas.

TABLE A.

	Population in 1871	Population in 1881	Increase	Rate of Increase per-cent
United Kingdom	31,484,661	34,884,848	3,400,187	10·80
COLONIES, POSSESSIONS, AND DEPENDENCIES ‡:				
In Europe§	320,851	327,805§	6,954	2·17
„ North America	3,829,670	4,520,415	690,745	18·04
„ W. Indies & Central America	1,088,596	1,243,861	155,265	14·26
„ South America	194,294	254,532	60,238	31·00
„ Africa	1,813,450	2,579,163	765,713	42·22
ASIA:				
In British India	191,307,070	204,108,762	12,801,692	6·69
„ Ceylon	2,405,287	2,763,984	358,697	14·91
„ Straits and other Settlements	433,119	590,084	156,965	36·24
„ Australasia	1,925,595	2,914,176	988,581	51·34
British Empire	234,802,593	254,187,630	19,385,037	8·26

* *Registrar-General's Report, Census* 1881, vol. iv, p. 75.

† *Registrar-General's Report, Census* 1871, vol. iv, p. 162.

‡ Exclusive of the Feudatory and Native States of India (area 509,284 square miles, population 49,817,919) and of Cyprus.

§ Including the Islands in the British seas.

TABLE B.—COLONIES—*Area and Population in* 1871 *and* 1881.

	Area in Square Miles		Population	
	1871	1881	1871	1881
EUROPE				
Isle of Man	227	227	54,042	53,558
Jersey	45	45	56,627	52,445
Guernsey & Adjacent Islands	31	31	33,969	35,257
Heligoland	5¼	1	1,913	2,001
Gibraltar	1⅞	2	25,216	23,991
Malta	115	117	149,084	160,553
	425⅛	423	320,851	327,805
NORTH AMERICA				
CANADA:				
Nova Scotia	21,731	20,907	387,800	440,572
New Brunswick	27,322	27,174	285,594	321,233
Quebec	193,355	188,688	1,191,516	1,359,027
Ontario	107,780	101,733	1,620,851	1,923,228
Manitoba	14,300	123,200	11,945*	65,954
British Columbia	220,000	341,305	10,586*	49,459
Territories	2,750,000	2,665,252	28,700	56,446
Prince Edward's Island	2,173	2,133	94,021	108,891
Newfoundland	40,200	40,200	146,536	179,509
The Bermudas	24	19	12,121	16,096
	3,376,885	3,510,611	3,789,670	4,520,415
WEST INDIES AND CENTRAL AMERICA				
The Bahamas	3,021	5,390	39,162	43,521
Turks and Caicos Islands	420	130	4,723	4,778
Jamaica	6,400	4,193	506,154	580,804
British Honduras	13,500	7,562	24,710	27,452
The Leeward Islands	738	740	120,131	122,765
The Windward Islands	775	794	284,078	311,413
Trinidad	1,755	1,755	109,638	153,128
	26,609	20,564	1,088,596	1,243,861
SOUTH AMERICA				
British Guiana	76,000	76,000	193,491	253,118
The Falkland Islands	6,500	3,664	803	1,414
	82,500	79,664	194,294	254,532

* Estimated population.

COLONIES.—*Area and Population in* 1871 *and* 1881—(continued).

AFRICA	Area in Square Miles		Population	
	1871	1881	1871	1881
Island of Ascension . . .	34	34	27	300
St. Helena	47	47	6,241	5,059
W. AFRICAN SETTLEMENTS:				
Sierra Leone	468	300	38,936*	60,546*
The Gambia	21	69	14,190*	14,150*
The Gold Coast	6,000	6,000	400,070*†	400,000*
Lagos	...	73	62,021*†	75,270*
Cape Colonies & Dependencies	218,410	241,900	667,673*	1,249,824*
Natal	11,172	18,755	293,832*	413,167*
The Mauritius & Dependencies	708	708	330,460*	360,847*
	236,860	267,886	1,813,450	2,579,163
ASIA				
British India	938,366	870,016	191,307,070	204,073,902
Perim	...	...	No separate Return	149
Aden	...	71		34,711
Ceylon	24,454	25,365	2,405,287	2,763,984
THE STRAITS SETTLEMENTS:				
Singapore	224	224	97,111	139,208
Penang	342	342	133,230	190,597
Malacca	640	640	77,756	93,579
Labuan & Smaller Islands	45	30	4,898	6,298
Hong Kong	32	29	120,124	160,402
	964,103	896,717	194,145,476	207,462,830
AUSTRALASIA				
Western Australia	978,000	1,060,085	24,785	29,708
Southern Australia	760,000	903,690	188,995	279,865
Victoria	88,198	87,884	731,528	862,346
New South Wales	323,437	316,320	503,981	751,468
Norfolk Island	13½	13	481‡	663
Queensland	678,600	669,520	120,104	213,525
Tasmania	26,215	26,215	99,328	115,705
New Zealand	106,259	104,403	256,393	533,801
Fiji	...	7,740	...	127,095
	2,960,722½	3,175,870	1,925,595	2,914,176

* Including Blacks and Coloured People.

† Estimated population.

‡ The population of Norfolk Island was composed as follows:—The Pitcairn Community, 297; the Melanesian Mission, 160; persons not included in either, 24; total, 481.

II.—United Kingdom.

The population of the United Kingdom amounted, on 4 April 1881, to 34,884,848; and, taking into account the islands in the British seas and also the natives of the United Kingdom serving abroad at that date in the army, navy, and merchant service, the total is raised to 35,241,482. This was 3,396,103 in excess of the population in 1871, the decennial rate of increase being 10·7 per-cent. In the three preceding periods the rate had been successively 2·5, 5·7 and 8·6 per-cent. A decrease of population occurred during the period 1871–81 in Ireland, the Channel Islands, and the Isle of Man; so that the increase in the aggregate population was entirely confined to England, Wales and Scotland. In England and Wales the rate of increase was 14·4 per-cent, and in Scotland 11·1 per-cent.

Natives of the United Kingdom abroad.

Of the 34,884,848 persons forming the population of the United Kingdom, 34,535,095 were born within its limits; while 349,753 were born abroad, namely, 145,863 in British colonies or dependencies, and 203,890 in Foreign States.

Against these 349,753 persons born out of the country, must be put the natives of the United Kingdom, who, at the date of the Census, were living abroad.

Abstract of Returns of Natives of the United Kingdom residing abroad at the time of the Census 1881.*

India	89,798
Other Colonies	988,934
In Foreign Countries—	
United States	2,772,169
France	36,447
German Empire	11,139
Italy	7,230
Russia	5,007
Other Countries	49,175
	3,959,899

* *Registrar-General's Report, Census* 1881, vol. iv, p. 106.

UNITED KINGDOM.—*Population, at each of the last Seven Censuses, and constituent parts.*

TABLE C.—*Population of the United Kingdom, of the Isle of Man, and of the Channel Islands, at each of the last Seven Censuses.*

	1821	1831	1841	1851	1861	1871	1881
England and Wales	12,000,236	13,896,797	15,914,148	17,927,609	20,066,224	22,712,266	25,974,439
Scotland	2,091,521	2,364,386	2,620,184	2,888,742	3,062,294	3,360,018	3,735,573
Ireland	6,801,827	7,767,401	8,196,597	6,574,278	5,798,967	5,412,377	5,174,836
	20,893,584	24,028,584	26,730,929	27,390,629	28,927,485	31,484,661	34,884,848
Isle of Man . . .	40,081	41,000	47,975	52,387	52,469	54,042	53,558
Channel Islands .	49,427	62,710	76,065	90,739	90,978	90,596	87,702
Army, Navy, and Merchant Seamen abroad, being natives of the United Kingdom . . .	289,095	260,191	202,954	212,194	250,356	216,080	215,374
	21,272,187	24,392,485	27,057,923	27,745,949	29,321,288	31,845,379	35,241,482

Emigration and Immigration.

The particulars in the following tables are extracted from the Board of Trade Returns for 1884, and show the total number of emigrants from the United Kingdom in the years 1815–1884, and their destinations. Previously to 1853 the nationalities were not distinguished; and the table has been divided into two periods—one before, the other after 1853,—so as to facilitate comparison with the succeeding table, which shows the emigration of persons of British origin only. A further table is added, giving the balance of emigration over immigration for the years 1870–1884. Since 1876 British emigrants and immigrants are distinguished from the total numbers.

TABLE D.*—*Statement of Emigration from the United Kingdom, including British Subjects and Foreigners, with the Destinations of the Emigrants.*

Years	United States	British North America	Australasia	Other Countries	Total
1815–1852	2,064,581	1,036,714	310,836	51,461	3,463,592
1853–1860	983,625	159,807	397,389	41,654	1,582,475
1861–1870	1,424,466	195,250	280,198	67,656	1,967,570
1871–1880	1,531,851	232,213	313,106	151,226	2,228,396
1881–1884	1,059,257	178,645	181,658	87,300	1,506,860
Total 1853–1884	4,999,199	765,915	1,172,351	347,836	7,285,301
Grand Total 1815–1884	7,063,780	1,802,629	1,483,187	399,297	10,748,893

TABLE E.*—*English, Scotch, and Irish Emigrants only (excluding Emigrants of Foreign Origin).*

Years	United States	British North America	Australasia	Other Countries	Total
1853–1860	805,596	123,408	365,307	18,372	1,312,683
1861–1870	1,132,626	130,310	267,358	41,535	1,571,829
1871–1880	1,087,372	177,976	303,367	110,204	1,678,919
1881–1884	704,860	139,672	175,490	64,643	1,084,665
Total 1853–1884	3,730,454	571,366	1,111,522	234,754	5,648,096

* Table D shows the total number of emigrants (both British subjects and foreigners) from the United Kingdom for the years 1815 to 1884. Table E gives the number of emigrants of British and Irish origin only for the years 1853 to 1884.

TABLE F.—BALANCE OF EMIGRATION.—*Total Emigration and Immigration, including British Subjects and Foreigners (United Kingdom).*

Year	Emigration	Immigration	Excess of Emigration
1870–1875	1,530,023	471,938	1,058,085
1876	138,222	93.557	44,665
1877	119,971	81,848	38,123
1878	147.663	77.951	69.712
1879	217,163	53,973	163.190
1880	332,294	68,316	263,978
1881	392.514	77,105	315,409
1882	413,288	82,804	330,484
1883	397,157	100,503	296,654
1884	303,901	123,466	180,435
Totals .	3,992,196	1,231,461	2,760,735

British and Irish Emigrants and Immigrants (excluding Foreigners).

Year	Emigration	Immigration	Excess of Emigration
1876	109,469	71,404	38,065
1877	95,195	63,890	31,305
1878	112,902	54,944	57,958
1879	164,274	37,936	126,338
1880	227,542	47,007	180,535
1881	243,002	52,707	190,295
1882	279,366	54,711	224,655
1883	320,118	73,804	246,314
1884	242,179	91,356	150,823
Totals .	1,794,047	547,759	1,246,288

From the above table, it appears that the net emigration from the United Kingdom in the 15 years 1870 to 1884 amounted to 2,760,735 persons. But the actual loss to the native population was considerably less, as in this number is included a certain proportion of foreigners. In the 9 years 1876 to 1884, for which the figures distinguish between natives and foreigners, the net number of emigrants included 456,362 foreigners, being 26·8 per-cent of the net number.

III.—England and Wales.

The total number of persons returned as living in England and Wales on the night of 3 April 1881 was 25,974,439. This was an increase of 3,262,173 in the decennium, or 14·36 per-cent, which was a higher rate of increase than in any decennium since 1831–41.

TABLE G.—*Population enumerated at each Census since* 1801 (*England and Wales*).

Year of Census	Males	Females	No. of Females to 1000 Males	Persons per Square Mile	Decennial Rate of Increase per-cent of Population
1801	4,254,735	4,637,801	1,026	153	...
1811	4,873,605	5,290,651	1,025	174	14·30
1821	5,850,319	6,149,917	1,021	206	18·06
1831	6,771,196	7,125,601	1.029	238	15·80
1841	7,777,586	8,136,562	1,030	273	14·52
1851	8,781,225	9,146,384	1,027	307	12·65
1861	9,776,259	10,289,965	1,035	344	11·93
1871	11,058,934	11,653,332	1,040	390	13·19
1881	12,639,902	13,334,537	1,043	446	14·36

Increase of Population.

The rate of increase of the population in England and Wales depends almost entirely upon two factors, namely, the birth-rate and death-rate; for, in comparison with these, emigration and immigration have but an insignificant effect. The rapid growth in the past decennium was due to the fact that the birth-rate was unusually high and the death-rate unusually low.

The difference between the total number of births and the total number of deaths (or the *natural increment* of the people) amounted to 3,426,480, or to an increase of 15·09 per-cent upon the population at the beginning of the period, while the actual increase was 3,262,173, or 14·36 per-cent. The combined effect of all other movements of the population, including emigration and immigration, thus resulted in a loss of no more than 164,307, or ·73 per-cent, in the whole period.

The increase of the population was by no means equably spread over the whole of the country. In 13 counties the population diminished, and in 26 other counties a lower rate of increase than that by natural increment occurred during the decennium.

Registration Counties in which the Population increased in the Decade 1871–81.

In the following Counties the *Actual* Increase exceeded the *Natural* Increase:

	Increase Actual	Increase Natural		Increase Actual	Increase Natural
Middlesex (extra Met.)	43·8	16·5	Leicestershire	18·6	16·8
Glamorganshire	27·7	20·3	Yorkshire (W. Riding)	18·5	16·3
Durham	26·3	23·2	„ (E. „)	18·2	15·2
Surrey (extra Met.)	26·2	16·0	„ (N. „)	17·7	16·4
Essex	25·3	17·1	Sussex	17·4	14·0
Notts	23·4	17·2	Cheshire	15·3	15·2
Lancashire	22·3	14·7	Carnarvonshire	11·1	10·0
Derbyshire	19·0	18·7			

In these Counties the *Actual* Increase fell slightly below the *Natural* Increase:

	Increase Actual	Increase Natural		Increase Actual	Increase Natural
Warwickshire	15·9	16·6	Northumberland	12·3	16·2
Staffordshire	14·8	20·2	Northamptonshire	11·6	16·0
Worcestershire	14·0	16·2	Merionethshire	11·0	13·5
Cumberland	13·8	14·5	Berkshire	10·2	14·4
Kent (extra Met.)	12·6	15·5			

In the following Counties the actual increase was much below the natural increase:

	Increase Actual	Increase Natural		Increase Actual	Increase Natural
Carmarthenshire	9·7	15·1	Denbighshire	7·4	11·3
Hants	9·6	13·5	Monmouthshire	6·7	16·5
Lincolnshire	8·2	14·6	Flintshire	5·2	12·6
Gloucestershire	7·4	13·1	Herts	4·0	13·9

Stagnant Populations.

	Increase Actual	Increase Natural		Increase Actual	Increase Natural
Beds	1·8	14·3	Wilts	1·0	12·7
Suffolk	1·8	13·5	Bucks	0·6	14·4
Somerset	1·7	12·0	Devon	0·4	10·2
Norfolk	1·6	11·1	Anglesey	0·04	6·9
Oxon	1·2	12·8			

In the following Counties the Population decreased in the Decade:

	Decrease		Decrease
Cornwall	8·9	Dorset	2·1
Hunts	8·3	Rutlandshire	1·6
Radnorshire	6·2	Westmoreland	1·3
Brecknockshire	4·9	Cambs.	0·5
Herefordshire	3·1	Shropshire	0·5
Cardiganshire	2·8	Pembrokeshire	0·2
Montgomeryshire	2·8		

The preceding list of counties, in which the population has increased at a greater rate than the natural increment, shows that those counties which contain mining, manufacturing, or industrial centres, attract surplus population; while the purely agricultural counties export labour. The movement has been from country to

town, the centres of industry having been fed at the expense of agricultural districts.

In each group of counties it is noticed that where an increase of population (larger than the natural increment) has occurred, the industrial class bears a large proportion to the total population, and the agricultural class a small proportion. In the counties where a small increase has occurred the proportions are reversed.

Urban and Rural Population.

The division of the country into sanitary areas, some of which are styled Urban and the rest Rural Sanitary Districts, furnishes a further method of determining the distribution of the population.

In April 1881 there were in England and Wales 966 urban sanitary districts; besides the 39 districts within the jurisdiction of the Metropolitan Board of Works, which appear in the following table as one district. Assuming these districts to represent the urban element, and the remainder to represent the rural element, the following would be an approximate distribution of the people*:

Table H.

Urban Sanitary Districts, with Populations of	Number of Districts	Aggregate Population 1881	Percentage of Population of England and Wales 1881
250,000 and upwards	6†	5,722,677	22·0
100,000–250,000	14	1,976,498	7·6
50,000–100,000	27	1,796,149	6·9
20,000– 50,000	98	2,958,177	11·4
10,000– 20,000	158	2,172,630	8·4
3,000– 10,000	469	2,618,321	10·2
Under 3,000	195	362,194	1·4
Total Urban Population . .	967	17,636,646	67·9
Total Rural „ . .	...	8,337,793	32·1
England and Wales . . .	...	25,974,439	100

The urban sanitary districts are of recent creation, and were in many instances constructed with little reference to existing

* *Registrar-General's Report, Census* 1881, vol. iv, p. 9.

† This includes the entire District of the Metropolitan Board of Works, which is here reckoned as a single urban sanitary district.

boundaries. Assuming that the rate of growth has been the same for the total aggregates as for those parts for which the necessary data are procurable, the following figures are given by the Registrar-General as representing the respective growths of the *present** urban and rural populations:

TABLE I.—*Urban and Rural Populations (England and Wales).*

	Population			Percentage of Population of England and Wales		
	1861	1871	1881	1861	1871	1881
Urban Population .	12,696,520	14,929,283	17,636,646	63·3	65·7	67·9
Rural ,, .	7,369,704	7,782,983	8,337,793	36·7	34·3	32·1
England and Wales	20,066,224	22,712,266	25,974,439	100	100	100

The following tables show the proportion of population living in towns and in country districts respectively at the Censuses of 1861 and 1871. For the Census of 1861 particulars are given of 781 towns, having a population of 1,000 and upwards. For 1871, 938 such towns are noted.

TABLE J.—*Population in* 1861 *of* 781 *Towns and of the Villages and Country Parts (England and Wales).*

	Town Population	Villages and Country Population	PERCENTAGE	
			Town	Country
England	10,606,963	8,347,481	56·	44·
Wales	354,035	757,745	32·	68·
Metropolitan Counties .	2,716,848	320,730	86·5	13·5
South-Eastern	946,142	809,551	50·2	49·8
South Midland	362,704	752,770	32·	68·
Eastern	382,726	793,993	32·5	67·5
South-Western	739,935	1,096,801	38·7	61·3
West Midland	1,354,203	1,112,433	49·	51·
North Midland	325,369	588,959	31·6	68·4
North-Western	1,968,891	965,977	62·1	37·9
Yorkshire	1,079,885	953,725	49·3	50·7
Northern	546,899	570,885	44·6	55·4
Monmouthshire & Wales	407,592	878,821	27·7	72·3

* Many of the districts which are at present urban, would not have been sufficiently populous to rank as urban in 1871, and still less in 1861. The urban population for 1861 and 1871, as given in the table, is therefore overstated.—*Note by Registrar-General.*

Population in 1871 *of* 938 *Towns and of the Villages and Country Parts* (*England and Wales*).

	No. of Towns	Town Population	Villages and Country Population	Percentage	
				Town	Country
England	858	13,573,630	7,921,501	63·1	36·9
Wales	80	467,774	749,361	38·4	61·6
Metropolitan Counties .	32	3,344,524	286,876	89·4	10·6
South-Eastern. . . .	85	1,124,108	882,801	51·9	48·1
South Midland . . .	55	380,270	806,572	31·2	68·8
Eastern	46	448,207	805,754	35·6	64·4
South-Western . . .	95	738,194	1,141,720	36·5	63·5
West Midland. . . .	105	1,657,218	1,082,255	51·6	48·4
North Midland . . .	79	630,563	796,572	41·6	58·4
North-Western . . .	129	2,677,905	702,791	72·7	27·3
Yorkshire	160	1,726,766	709,589	59·8	40·2
Northern	60	753,879	603,119	48·9	51·1
Monmouthshire & Wales	92	559,770	852,813	30·5	69·5
	938	14,041,404	8,670,862	61·8	38·2

This table is a summary of Table 34, *Census,* 1871, vol. iv, p. 33.

Density of Population.

The density of the population may be expressed in different ways. The average number of persons to the square mile may be stated, or we may adopt the estimate suggested by Farr of the amount of space available, on an average, for each person.

The gradual increase in the density of population in this country has been as follows:

TABLE K.

Date of Census	Persons per Square Mile	Acres per Person	Proximity in Square Yards
1801	153	4·19	153
1811	175	3·66	143
1821	206	3·10	132
1831	239	2·68	122
1841	274	2·34	114
1851	308	2·08	108
1861	345	1·86	102
1871	390	1·64	96
1881	446	1·43	90

According to the most recent returns, there are but two European states in which the density of population is equally great. These countries are Saxony and Belgium, in which in

1880 there were respectively 514 and 485 inhabitants to the square mile.*

The following are the countries next in order of density of population:

Holland	327†	Germany	216
Italy	249	Luxemburg	210
Japan	234	France	184
China	225	Switzerland	178

The following estimate of the area and population of the world is extracted from the *Victorian Year-Book*, 1883–4:

TABLE L.—THE WORLD—*Area and Population.*

	Area in English Square Miles	Estimated Population	Persons to the Square Mile
Europe	3,756,002	327,743,400	87·3
Asia	17,208,208	795,591,000	46·2
Africa	11,511,776	205,823,200	17·9
America	14,850,631	100,415,400	6·8
Australasia and Polynesia	3,455,802	4,232,000	1·2
Polarland	1,728,585	82,500	·05
Total	52,511,004	1,433,887,500	27·3

Birthplaces of the Population.

There is a tendency in the population, as has been already pointed out, to migrate from agricultural to industrial districts; but, notwithstanding this constant stream of migration from country to town, the native population shows stationary habits of a very decided character.

Of the natives of England and Wales who were in the kingdom at the time of the Census of 1881, no less than 75 per-cent were enumerated in their native counties.‡ The migration from country to town operates to a great extent in circles; the rural population of each district being attracted to the towns in its own neighbourhood. Owing to this tendency many persons in migrating from the country do not quit their native districts, but move to neighbouring towns in the same registration counties.

Comparison of the sexes shows that females are slightly more prone to migrate than males. This fact may be attributed to the demand for female domestic service, and the employment of

* *Registrar-General's Report, Census* 1881, vol. iv, p. 13.
† *Victorian Year-Book*, 1883–4, p. 70.
‡ *Registrar-General's Report, Census* 1881, vol. iv, p. 51.

women in factories; and, further, that on marriage many women are called upon to leave their native districts.

The following table gives the proportion between the total number of natives, and the number enumerated in their native divisions. Of 100 enumerated natives of England and Wales, there were enumerated in their native divisions:

	Males	Females
London	80·9	80
South-Eastern Counties	59·9	57·9
South Midland Counties	83·9	83·4
Eastern Counties	74·5	72·2
South-Western Counties	75·6	74·7
West Midland Counties	83·1	82·1
North Midland Counties	80·4	79·9
North-Western Counties	92·1	92·7
Yorkshire	87·6	88·0
Northern Counties	89·0	88·4
Monmouthshire and Wales	88·0	85·8

Effect of Migration to Towns.

The stream of migration to towns of large numbers of persons at the working ages has an important effect on the general distribution of the population.

Its principal results may be summarized as follows:

1. To leave an undue proportion of old lives in the country.
2. To draw an abnormal proportion of adults at productive ages to towns.
3. To produce a high birth-rate in towns.
4. To cause a disproportion between the relative numbers of males and females in town and country.

In 1881, the distribution of Males and Females was as follows*:

Ages	Females to 100 Males: Urban	Rural
0– 5	101	100
5–10	101	99
10–15	102	95
15–20	109	85
20–25	114	99
25–35	109	106
35–45	108	105
45–55	113	105
55–65	119	102
65–75	131	104
75–85	147	108
85–	193	134
All ages	108	100

Ages of the Population.

The age-distribution of the people underwent very little change in the interval between 1871 and 1881. The proportion of persons under 25 was slightly increased.

* *Registrar-General's Report, Census* 1881, vol. iv, p. 22.

Persons Under and Over 25 Years of Age per Million of Population.

	Under 25	Over 25
1861 . . .	543,807	456,193
1871 . . .	545,397	454,603
1881 . . .	552,237	447,763

TABLE M.—*Analysis of Population—Numbers at Productive and Non-Productive Ages in every Million of Population.*

Ages	Males	Percentage	Females	Percentage
CENSUS 1841				
-15	181,091	37·0	179,815	35·2
15-65	287,226	58·8	307,481	60·1
65-	20,404	4·2	23,983	4·7
	488,721	100	511,279	100
CENSUS 1851				
-15	177,993	36·3	176,423	34·6
15-65	290,833	59·4	308,409	60·4
65-	20,990	4·3	25,352	5·0
	489,816	100	510,184	100
CENSUS 1861				
-15	178,796	36·7	177,526	34·6
15-65	287,324	59·0	309,918	60·4
65-	21,080	4·3	25,356	5·0
	487,200	100	512,800	100
CENSUS 1871				
-15	180,883	37·2	180,255	35·1
15-65	284,439	58·4	307,103	59·8
65-	21,593	4·4	25,727	5·1
	486,915	100	513,085	100
CENSUS 1881				
-15	182,043	37·4	182,491	35·6
15-65	283,967	58·4	305,738	59·5
65-	20,618	4·2	25,143	4·9
	486,628	100	513,372	100

Condition and Sex.

The Age at Marriage is a factor of prime importance in the growth of a nation; and the laws which regulate marriage must be briefly referred to.

The law regards marriage in the light of a contract, and applies to it, with some exceptions, the ordinary principles which attach to other contracts. In the contract of marriage it is not necessary, in order that a marriage should be effectual, that the parties should have attained their full age of 21. A male person is enabled by law to consent to matrimony at the age of 14, and a female at the age of 12; though this is restricted by the authority entrusted to a parent or guardian of an infant. And where either of the parties is under the age of 21, oath must be made that the consent of the person or persons whose consent is required has been obtained.*

At the different Census periods, the average then ages of husbands and wives were as follows:

	Husbands	Wives	Difference
1851 . . .	43·0 years	40·5 years	2·5 years
1861 . . .	43·0 „	40·5 „	2·5 „
1871 . . .	43·0 „	40·7 „	2·3 „
1881 . . .	43·1 „	40·7 „	2·4 „

These figures include the whole population, labouring classes as well as the rest of the community.

The annual rate of fertility was 286 per 1,000 wives at reproductive ages.

Of the persons enumerated in England and Wales on 4 April 1881, 12,639,902 were males, and 13,334,537 were females. To each 100 males there were 105·5 females. A preponderance of females is found to exist in almost all European countries, and this notwithstanding the fact that male births are more numerous than female.

In England and Wales the proportion of males to females among infants born in the years 1871 to 1880 was 103·8 of the former to 100 of the latter. The ratio varies in different countries, but the same rule almost always prevails.

Proportion of Male to Female Births at Different Periods (England and Wales).

	Boys to 100 Girls
1856–60	104·6
1861–65	104·3
1866–70	104·1
1871–75	103·9
1876–80	103·8

* *Stephens's Commentaries*, 9th edition, 1883, p. 239.

During the whole of the above period (1856–80) the mean age at marriage remained nearly constant, namely, 26·7 years.

Various causes contribute to the waste of life which reduces the number of the male inhabitants of a country. Hazardous occupations, and service in the army and at sea, swell the male mortality; and emigration attracts more men than women to other lands. About 63 per-cent of the adult emigrants from the United Kingdom in the years 1877 to 1884 were males.

Mean Age at Marriage of Persons Married in the 10 *Years* 1861–70.

Total Men married . . .	27·8 years	Total Women married . .	25·6 years
„ Bachelors married .	25·7 „	„ Spinsters „ . .	24·3 „
„ Widowers „ .	42·4 „	„ Widows „ . .	39·1 „

In the 10 *Years* 1871–80.

Total Men married . . .	27·9 years.	Total Women married . .	25·7 years.

In prosperous times men have a greater tendency to marry than in dull times. The *marriage-rate* is usually reckoned by comparing the number of marriages with the population; but this method does not yield satisfactory results. In countries possessing an old-established population, the frequency of marriage does not depend on the total population, nor, chiefly, upon the numbers of marriageable women, but almost entirely upon the number of marriageable men in the community. In the Colonies, on the other hand, where the proportion of marriageable women is small, the marriage-rate is mainly controlled by the number of marriageable women.

It will be more satisfactory, therefore, to supplement the ordinary marriage-rate by a comparison of the number of marriages with the total number of persons at marriageable ages.

TABLE N.—*Marriage-Rate per* 1,000 *of Mean Population (England and Wales).*

Census Year	Mean Population	Number of Marriages in Census Year	Marriages per 1,000 of Mean Population*
1851	17,982,849	154,206	8·58
1861	20,119,314	163,706	8·14
1871	22,926,710	190,112	8·29
1881	26,209,276	197,290	7·53

* The numbers doubled give the *persons* married per 1,000 of the population.

In the above table, under the heading Mean Population, the whole community is included; but in order to approximate to the rate of marriage among the marriageable portion of the population, it is necessary to eliminate all married persons, and those at unmarriageable ages.

In the following table the number of bachelors and widowers between the ages 15 and 65, and the number of spinsters and widows between 15 and 45, living in the middle of the year, are compared with the number of marriages in four Census years:

TABLE O.

Census Year	Bachelors and Widowers between 15 and 65	Spinsters and Widows between 15 and 45	Number of Marriages per Annum	Marriages per 1,000 of Marriageable	
				Men	Women
1851	2,469,809	2,230,262	154,206	62·42	69·14
1861	2,591,922	2,382,879	163,706	63·15	68·69
1871	2,868,145	2,649,949	190,112	66·24	71·70
1881	2,967,667	3,046,431	197,290	66·48	64·77

The following table of the rates of marriage in Australia for the year 1881 is given in order to compare the home rates with those in a Colonial population:

TABLE P.—*Marriages per* 1,000 *of the Population in each Colony, and per* 1,000 *Marriageable Men and Women* (*Australia*).

Colony	Per 1,000 of Population	Per 1,000 Marriageable	
		Men	Women
New South Wales . . .	8·50	62·56	74·57
Queensland	8·42	59·94	97·33
South Australia	8·37	71·78	70·86
Tasmania	7·45	63·56	54·50
Victoria	6·94	59·04	49·39
New Zealand.	6·76	50·41	73·86
Western Australia . . .	6·66	36·50	65·47

IV.—Population of England and Wales, and of London.

Year	England and Wales	London	Persons in London to 100 in England and Wales
1801	8,892,536	958,863	10·78
1811	10,164,256	1,138,815	11·20
1821	12,000,236	1,378,947	11·49
1831	13,896,797	1,654,994	11·91
1841	15,914,148	1,948,417	12·24
1851	17,927,609	2,362,236	13·18
1861	20,066,224	2,803,989	13·97
1871	22,712,266	3,254,260	14·33
1881	25,974,439	3,816,483	14·69

Since the commencement of the century, the population of the Metropolis has been increasing at a more rapid rate than that of the country at large; and, whereas in 1801, 1 in every 9·3 inhabitants of England and Wales resided in London, the proportion had risen in 1881, to 1 in every 6·8 persons.

The above figures represent the population of "Inner London", or "Registration London." "Inner London" is the London of the Registrar-General's Report, and is practically conterminous with the District of the Metropolitan Board of Works. "Greater London" consists of the Metropolitan and City Police Districts.

The total population of London in 1871 and 1881 was as follows:

	1871	1881
Central Area	952,880	878,556
Rest of Inner London .	2,301,380	2,937,927
	3,254,260	3,816,483
Outer Ring	631,381	950,178
Greater London . . .	3,885,641	4,766,661

Thus, taking the population of Greater London in 1881, there were 18·3 persons in London to 100 in England and Wales. In

other words, 1 person in every 5·4 persons of the whole population was found within the circuit of "Greater London."

The population of London is recruited by immigrants from all the counties of England and Wales, and from Scotland and Ireland; also from the British Colonies, and from various foreign countries. In determining the contribution of different counties to swell the population of the Metropolis, two considerations mainly operate:

1. The proximity of the county to the Metropolis, and the relative size of the county.
2. Whether any county has a competing attraction. For example, Yorkshire and Lancashire send a smaller contingent than Devon and Somerset. The reason being that Yorkshire and Lancashire are both industrial centres, whereas in Devon and Somerset there is not sufficient industry to employ the native population.

The following abstract gives the Birthplace of the Population of London, at the Census of 1881:

Of 1,000 *persons enumerated in London the Number born in each County, &c., or Abroad:**

Where born	
London	629·4
Middlesex (extra Metropolitan)	25·6
Kent (extra Metropolitan)	25·0
Essex	24·3
Surrey (extra Metropolitan)	16·6
Devon	15·5
Hampshire	14·1
Norfolk	14·0
Suffolk	13·1
Sussex	11·6
Somerset	11·4
Other English and Welsh counties	137·3
Scotland	13·0
Ireland	21·2
British subjects born in foreign countries and abroad	5·1
British Colonies	7·0
Foreigners	15·8
	1,000

* *Registrar-General's Report, Census* 1881, vol. iv, p. 59.

V.—Summary of Infirmities, 1881.*

The Blind.—The total number of persons returned as afflicted by blindness was 22,832, being in the proportion of 1 blind person in every 1,138.

The proportion of the blind to the population has decreased with each successive Census since 1851.

1851, 1 Blind person to every	. . . .	.	979
1861 „ „	. . . .	.	1,037
1871 „ „	. . . .	.	1,052
1881 „ „	. . . .	.	1,138

Deaf Mutes.—The persons included in this return were those only who were returned as "Deaf and Dumb", or as "Dumb"; and also those returned as "Deaf", who were inmates of deaf and dumb institutions.

The following is the proportion of Deaf Mutes at each Census since 1851:

1851, 1 Deaf Mute in	. . . . .	1,738
1861 „	. . . . .	1,640
1871 „	. . . . .	1,972
1881 „	. . . . .	1,953

The Insane.—Persons of unsound mind are variously returned in the schedules as Lunatic, Idiot, and Imbecile. The total number of persons in 1881 returned as suffering from some or other form of insanity was 84,503; being in the proportion of 3,253 per million of the whole population, or 1 in every 307. In 1871 the proportion was 1 in every 329.

Of the 84,503 insane persons, 39,789 were males,
and 44,714 „ females;
being in the proportion of 1 in every 318 males,
and 1 in „ 298 females.

It is pointed out, in the Registrar-General's Report, that the returns respecting Insanity are incomplete; since there is good reason to believe that statements made by persons as to the deficiencies, mental or bodily, of their children or other relatives are not worth the cost and labour of collection and tabulation.

* *Registrar-General's Report, Census* 1881, vol. iv, p. 60.

VI.—Occupations of the People, 1881.

Information has been collected at every Census with the view of ascertaining the occupations of the people; but the returns of the first four Censuses failed to bring out satisfactory results, in consequence of the means adopted for eliciting the facts.

The returns in 1801 made it impossible to decide whether females of the family, children and servants, were to be classed as of no occupation, or of the occupation of the adult males of the family.

The enquiries of 1811 and 1821 ascertained the number of families employed (1) in agriculture; (2) in trade, manufactures, and handicraft; and (3) those not comprised in either of the other two.

In 1831, enquiry as to occupation was applied to every male person aged 20 and upwards. The number of female servants was also returned.

In 1841, another change was made in the mode of procedure. Instead of circulating lists to contain by anticipation every existing trade or calling, the enumerator was directed to insert each man's description of himself opposite his name. The result was that many occupations were returned that were not found in the list of 1831; while in the case of important manufactures, minute subdivisions of labour were separately entered in the schedules.* The number of distinct modes of employment for Great Britain was 877; and for London, 757.

On comparing these figures with the results of the Census of 1881, one of the principal features of modern life is observed, namely, the extreme minuteness of the subdivision of labour. The dictionary of occupations used in the Census of 1871 comprised almost exactly 7,000 names. But in 1881 it was found that, owing to the greater subdivision of employment which had sprung up since that dictionary was compiled, it had become practically obsolete. A new dictionary was consequently prepared, which contained between 11,000 and 12,000 different occupations.

Of the population of England and Wales, not less than 57 per-cent are returned as "unoccupied", or, more properly speaking, pecuniarily non-productive. That so large a proportion

* Preface to the Occupations Abstract, *Census Report*, 1841 (*British Almanac and Companion*, 1845, p. 38).

should be thus returned is probably owing to the form of the schedule. Of the unoccupied class, not less than 8,936,851 comprised persons under 15 years of age, many of whom were preparing for the duties of life. Another section, numbering 532,441, were between 15 and 20 years; while 676,393 were upwards of 65 years of age. Two-thirds of the non-workers are thus accounted for; while of the remaining one-third the majority were women, of whom the greater part were married.

Classification of occupations was made under six chief heads, with the following results:

Class	Males	Females	Total	Percentage of Population
Professional . . .	450,955	196,120	647,075	2·5
Domestic	258,508	1,545,302	1,803,810	6·9
Commercial . . .	960,661	19,467	980,128	3·8
Agricultural . . .	1,318,344	64,840	1,383,184	5·3
Industrial	4,795,178	1,578,189	6,373,367	24·5
Indefinite and Non-productive . .	4,856,256	9,930,619	14,786,875	57·0
	12,639,902	13,334,537	25,974,439	100

The growth of Female Industry, in its various forms, may be said to be the most striking feature of the Census of 1881. The number of females returned as engaged in some definite occupation is not more than half the number of males. But if to the females so returned be added the wives not enumerated as engaged in definite occupations, but who in many instances help materially towards maintaining the family, the number of occupied females equals the number of males. In the following occupations, the females outnumber the males:

Actresses, 108 to every 100 Actors.

Steel-pen Makers . .	1,138	Females	to every	100 Males.
Envelope Makers . .	1,105	„	„	„
Bookbinders . . .	111	„	„	„
Cotton Manufacture .	164	„	„	„
Hosiery Trade . .	114	„	„	„
Woollen Cloth . .	102	„	„	„
Worsted Manufacture .	180	„	„	„

VII.—General Observations.

The lines of this paper were designed with the intention of bringing into prominence the development of the Census system, from its commencement at the beginning of this century to the present time; with the further object of condensing into manageable shape the facts relating to the wonderful growth of the population during that period. At the point selected for the outset of our review,—namely, the close of the 17th century,—England contained about 5,200,000 inhabitants. This number was increased in a little over 100 years by 71 per-cent; as in 1801 the enumerated population was 8,892,536. This rate of increase, however, was far exceeded in the following period of 80 years, when the population rose by 192 per-cent. The Census has thus far corresponded with the period in which the population of the United Kingdom has most largely increased, and in which have arisen those problems connected with a complex social life which it is the study of the actuary to solve.

When the constituent parts of the United Kingdom are examined (Table C) it appears that by far the largest increase has arisen in England and Wales. The population of Scotland has increased at a slower rate, while that of Ireland has decreased.

The rates between the Censuses of 1821 and 1881 were as follows:

	Increase	Increase per-cent
England and Wales .	13,974,203 .	116·45
Scotland	1,644,052 .	78·62
	Decrease	Decrease per-cent
Ireland	1,626,991 .	23·92

It has been already shown that the net results of migration, in the period under review, have exercised only a very slight influence on the population of England and Wales. But in Ireland emigration is largely responsible for the reduction in numbers. The returns show that the Irish are the most migratory people of the three kingdoms; and a considerable stream of emigration flows from their ports into England.

Among the prominent features of the population of Great Britain, and next in importance to the numerical increase thereof, stands the migration from country to town, which every Census discloses. In 1851, the inhabitants of the towns and of the country were equally balanced. Since that date, an increasing proportion has been found among the urban population, until in

1881 the dwellers in towns amounted to 67·9 per-cent of the population (Table I). The surplus population moving in search of food and employment, may be traced from the agricultural counties to industrial centres. The greatest increase in urban communities is to be found in the Metropolitan counties, the North Midland counties, the North-Western counties, and Yorkshire; while in the South Midland and South-Western counties, the town populations appear to be either stationary or decreasing.

The important development of the Census, first made in 1871, by which a simultaneous enumeration is taken of the whole population of the empire, marked a new departure in statistics. A fresh range of enquiry has been opened out, by which questions of great importance may be approached. Materials are furnished for ascertaining the relative growth of different colonies—their progress by emigration or natural increment. The Census returns, in conjunction with death-registers, may be usefully employed to compare the rates of mortality in different parts of the empire, with the object of ascertaining the extra risks which insurance offices are called upon to bear. But, in any investigation based upon Census returns, discretion is required when dealing with the facts in their original form. For the purpose of forming a mortality table, we require to know the total numbers living and dying at particular ages; and, in order that the calculations should be trustworthy, it is essential that the information should be complete. Now the facts relating to the numbers living must be sought in the Census lists; and, although there is no reason to question the substantial accuracy of the numbers enumerated on a particular day, entire confidence cannot be placed on the distribution of population according to age. Again, the registration system provides an accurate record of deaths, but it does not guard against mistakes as to age. In order to arrive at a satisfactory conclusion as to the rate of mortality which has prevailed, care must be exercised, not only to minimize the errors which the records contain, but also to allow for the effect of migration and any other special causes which may have influenced the death-rate. Various expedients have been adopted for securing a trustworthy distribution of age, and deducing the rates of mortality. But the whole subject of the construction of mortality tables from Census returns deserves further attention, and offers an attractive field of study.

History of Life Assurance in the United Kingdom. By CORNELIUS WALFORD, F.I.A.

[Read in abstract at the Institute, 22 Dec. 1884.]

To this Essay was awarded the first SAMUEL BROWN Prize (1884), the Syllabus of which will be found in Vol. xxiv, p. 145.

LIFE ASSURANCE is the compound growth, first, of our commercial necessities, aided largely by a love of speculation, and later, of our progressive civilization. For the former, rough and ready means of estimation were resorted to; for the latter, a long and elaborate course of progressive investigation was needed.

The development of the business has extended over some three or four centuries, perhaps more. It has passed through three distinct phases, as (1). The Experimental Period; (2). The Speculative or Transitional Period; (3). The Period of Scientific Exactitude. These periods, of course, more or less overlap each other, but they each possess very marked distinctions.

PRELIMINARY SURVEY.

It has to be remarked that during the constantly recurring epidemic visitations of the middle ages, anything depending upon the duration of human life could but be a lottery. There were no means even of approximate estimate other than tradition could supply. Life insurance, except as a bet or hazard between two or more individuals, was therefore impossible. And yet it was practised to an extent of which we can only judge by collateral circumstances—one of these being the existence of forms of contract exactly adapted to the nature of the business. These early contracts were indeed based, alike in form and expression, upon those adopted in Marine Insurance, which, it is generally admitted, had an earlier origin than that claimed for Life Insurance.

The class of Life Insurance chiefly in use during the experimental period was that of assuring mariners, *i.e.*, masters of ships, against death or captivity during the prosecution of their voyage; in insuring merchants against captivity by pirates—for in early times merchants accompanied their maritime ventures. The mode of undertaking these risks was by individual underwriters taking certain defined portions thereof at so much per-cent premium.

Again, there were also contracts for children's endowments, and various other contingent risks, specially devised in view of evading the *usury laws,* which latter were sought to be strictly enforced, by the Romish Church in the first instance, and afterwards by enactments in our own Statute book; and there being no funded system of National finance in existence by which money could be steadily improved at a fixed rate of interest, until near the close of the seventeenth Century (1690),* all manner of Life Annuity dealings were entered into as a means of gain and investment.

The speculative or transitional period is one of much interest. All subordinate offices in the service of the State were the subject of sale and purchase—sale by the patron, purchase by the incumbent. It was obvious that the value of a "place for life" depended upon the age of incumbents; but there were no scientific means of determining this proper value.

Church lands, and houses built thereon, were granted upon lives—"leases for lives"—usually three; on the death of the last of which the property reverted to the Church, and was only regranted, if at all, upon the payment of a considerable fine. Life Insurance was much needed to render such transactions financially safe.

Mutual Contribution Societies were founded; and in default of the means of calculating the expected mortality amongst the members, but little regard was paid to age on admission. The old were, indeed, frequently admitted on the same terms as the young, or where a distinction came to be made it was not based upon principles of computation, but was simply arbitrary; and various expedients had to be devised to meet the circumstance that nothing could be fixed in the way of accruing benefits.

Many Annuity Societies were formed in various parts of the kingdom; but in the absence of available scientific data on which to base their operations, they proved most delusive. Reversionary interests could not be accurately valued, and hence were the subject of speculation only. Even schemes of National finance were ventured upon in an equal absence of guiding principles: and extravagant advantages were offered—see the Early Schemes of Government Life Annuities, to say nothing of Tontine projects. Friendly Societies were founded without even an approximate idea of the pecuniary equivalents to be demanded for the benefits

* In Venice a public funding system was brought into use as early as 1173. In Florence in 1340.

offered. Finally, there came the stage of scientific exactitude in the progress of life contingencies.

Life Assurance Associations could now undertake, in return for certain fixed contributions, to guarantee on the expiration of the lives respectively insured, certain specific advantages. Such Associations might therefore be founded and carried on either by trading Companies, who entered into contracts in view of profit; and who, from the beginning, possessed funds which made the contract certain of performance in the absence of fraud. Under such conditions Life Insurance could be advantageously applied to many business purposes, wherein the element of certainty was the one thing needed; and the absence of speculation commended it to the judgment of prudent men, as a means of making provision for families.

In order to pass from the first of the preceding stages to the last, many steps had been necessary. First, in regard to the abatement of Pestilence; steps were taken in most of the municipal towns, in the direction of cleansing the public streets, into which animal and vegetable refuse and other abominations had been heretofore indiscriminately thrown. As to the Metropolis, which usually suffered more severely than the smaller towns from plague visitations—its burning in 1666, was the "baptism of fire" by which alone it became purified, and rendered even capable of its future development as the capital of the kingdom.

Bills of Mortality came to be regarded as of importance in the light of being barometers of the Public Health. They were introduced into the principal towns by slow degrees; and their results were placed on permanent record. From the Bills so kept were afterwards deduced the true data for life measurement.

The *Laws of Chance* came to be developed, originally very much in the interest of the all-prevailing gaming which pervaded Europe during the seventeenth and most of the eighteenth Century. A yet higher class of mathematics soon afterwards elaborated the doctrine of mathematical probability. The application of these higher mathematical methods to the data supplied by the Bills of Mortality and other mortality observations, led to the development of the science of Life Contingencies.

The first Mortality Table scientifically constructed by means of which the probable duration of human life could be accurately computed, was prepared by Halley, the Astronomer Royal of England, and submitted to the Royal Society in 1622.

It seems necessary to state that Halley's table did not immediately lead to an adoption of the improved methods of computation which it made available. This was probably because its results were deduced from foreign observations, which it may have been thought did not apply to life in England.

Attempts were therefore made during the next Century to construct other tables based upon English observations—especially upon those of London; and afterwards upon those of the central Town of Northampton.

From the accomplishment of this last result by Dr. Price in 1769, dates what may be termed a general adoption of Life Assurance for its best and noblest purposes.

This preliminary survey of the stages through which Life Assurance has passed in its course to perfection, is made with the view of preparing the mind for a more comprehensive review of the facts which are to follow. Stated generally, the progress has been a threefold one—Juridical, as applied to the form of the contract and its construction; Mathematical, as applied to the assumptions of the law of Mortality, and the correct deduction of the financial elements; Social, as securing the confidence necessary for its extended use as a branch of domestic economy.

It is now necessary that we enter upon a more detailed survey of the main incidents upon which the fabric of Life Assurance has been built up; and it will be convenient in so doing to preserve the distinctive periods which I have assumed to be marked out in the progress of the business. It has not been deemed necessary to encumber the text with references to constantly recurring authorities; but in most cases the leading source of information is indicated.

I.—Experimental Period.

In a work called *Le Guidon,* sometimes *Le Guidon de la Mer,* believed to have been compiled for the use of the Merchants of Rouen, during the fifteenth Century—but of which there exist many editions of various dates—we gain the first glimpse of the mode of Life Insurance as carried on in Europe in the later middle ages. The author says, in his enumeration of the branches of insurance then practised—probably in the sixteenth Century:

"In other countries (than France) where the bodies of people may be captured, and reduced to bondage, there are various usages for the insurance of the body and life of man, whether they be of free condition, or slaves; which customs will not be mentioned here,

because in France, men of whatever nation are of frank and free condition."

It may be assumed that this branch of Insurance had reference mainly to indemnity against captivity.

It may be mentioned in this connection that there existed in London during the Anglo-Saxon period (827 to 1013) a Gild, the primary object of which was the recovery of stolen live stock or slaves. It quite resembled in its constitution the Mutual Contribution Life Associations of a later period. One of its regulations was this :

"A theowman [*i.e.* a slave] shall be compensated for at the maximum rate of half a pound, or according to his value—the money to be raised by a call, as before mentioned. If he has stolen himself [*i.e.* run away from his owner] he shall be stoned, and every brother who has a slave shall contribute 1*d.* or a halfpenny, according to the number of the brotherhood. If the slave shall make good his escape, he shall be compensated for according to his value."—*Walford's Guilds*, pp. 24, 25.

Returning to *Le Guidon,* the author further says :

"Another kind of Insurance is made by other nations upon the life of men, in case of their decease upon their voyage, to pay certain sums to their heirs or creditors. Creditors even may insure their debts, if their debtor remove from one country to another; the same can be done by those having rents or pensions, so as in case of their decease, to continue to their heirs such pension or rent as may be due to them. Which are all stipulations forbidden, as against good morals and customs, from which endless abuses and deceptions arose, whence they have been constrained to abolish and prohibit the said usages; which is also to be prohibited and forbidden in this country (France)."

These things are spoken of as having primarily existed and been abandoned. Now there is most abundant evidence of such having been the case, by passages in the Maritime Codes of the various European nations.

In 1574 there occurred an event which would have rendered the early history of Life Assurance in England easy of demonstration—but for a calamity: the primary event was that Queen Elizabeth granted to one Richard Chandler the right to make and Register all manner of Assurance policies which should be granted upon any ships or merchandise, or upon "any other thing or "things, in the Royal Exchange in London, or any other place "within the City, by any manner of persons, of what nation, "condition, or quality soever." Under this patent Chandler

established a "Chamber of Insurance" in London, similar to those existing in Barcelona (founded probably in the thirteenth Century), in Bruges (founded 1310), in *Amsterdam* (1598), in *Antwerp,* and in many other places. The object of which Chambers was to register all Contracts of Insurance negociated, and to record the terms thereof for reference in case of dispute—no policies probably being written in some cases. The calamity which destroyed this Chamber and, it is presumed, its records, was the Great Fire of London in 1666. But for this event, records of the most profound interest would have been available: for the more exceptional the nature of the contract, the more necessary would have been its registration (*see* 1583).*

Earliest known Life Assurance Policy. On the 18 June 1583, was made at the Office of Insurance "within the Royal Exchange" in London (which no doubt was the Chamber of Insurance already referred to), a Contract of Life Assurance concerning which very full details have been preserved in consequence of a dispute of a technical character, which was raised by the underwriters. As this is not only the earliest contract of the kind made in England, which is available for reference, but is also the first recorded Life Insurance case before the English Courts, I propose to set out the contract *in extenso.*

"In the name of God, Amen. Be it knowne unto all men by theise presentes, that Richard Martin, Citizen and Alderman of London, doth make assurance and causeth himself to be assured upon the naturall life of William Gybbons, Citizen and Salter, of London, for and during the space of xij monethes next ensuinge after the underwriting hearof by the assurers heareafter subscribed fullie to be complete and ended. The which assurance wee the persons heareafter named, merchantes of this Citie of London, for and in consideracion of certeine currant money of England by us received at the subscribing hereof, of the said Richard Martin, after the rate of viij$^{li.}$ sterling per-cent (whereof we acknowledg ourselves—and everie of us by these presentes trulie satisfied and paid) do take upon us to beare. And we do assure by thiese presentes that the said William Gybbons (by what addiceon soever he is or shall be named or called) shall by God's grace contynue in this his naturall lief for and during the space of xij monethes next ensuinge after the underwriting heareof by everie of us the assurers, or in default thereof everie of us to satisfye, content and paie, or cause to be satisfied, contented and pay^{d} unto the said Richard Martin, his executors, administrators or assignes, all such severall summes of money as we the assurers shall hereafter severally subscribe, promising and binding us eche one for his owne

* For a detailed account of these Chambers of Insurance, see the *Insurance Cyclopædia,* under that title.

part, our heiers, executors and administrators by these presentes, That if it happen (as God defend) the said William Gibbons to dye or decease out of this present world by any wayes or meanes whatsoevere before the full end of the said xij monethes be expired, that then we, our heiers, executors or assignes w^th^in two monthes next after true intimaceon thereof be to us, our heiers, executors or administrators lawfullye given, shall, will and truly content and pay, or cause to be contented and paied unto the said Richard Martin, his executors, administrators or assigns all such summe and summes of money as by us th' assurers shal be heareafter severally subscribed w^th^out any further delaye: It is to be understanded that this present writing is and shall bee of as much force, strength and effect as the best and most surest pollicy or writing of assurance which hath bene ever heretofore used to be made upon the life of any person in Lumbard Street, or nowe w^th^in the Roiall Exchange in London. And so the assurers be contented and doe promise and binde themselves and everie of them, theire heiers, executors and administrators by these presentes to th' assured, his executors, administrators and assigns for the true performance of the promises according to the use and custome of the said street or Royall Exchange: And in testimony of the truth, the assurers have heareunto severally subscribed theire names and summes of money assured. God send the said William Gibbons helth and long lief. Geven in the office of assurance w^th^in the Royall Exchange aforesaid the xviij^th^ day of June 1583."

The persons who underwrote the policy, and the amount which each so bound himself to pay were as follows: John Barker, 50*li.*; Leonard Holydaye, 25*li.*; William Browne, 25*li.*; John Castelin and Anthony Marlor, 25*li.*; Henry Clitherowe, 25*li.*; Edmund Hogan, 33*li.* 6*s.* 8*d.*; John Stokes, 33*li.* 6*s.* 8*d.*; Henry Colthirst and Nicholas Stile, 25*li.*; John Newman, 25*li.*; Symon Lawrence and Oliver Stile, 25*li.*; the Executrix of William Towerson deceased, 33*li.* 6*s.* 8*d.*; William Becher, 25*li.*; and Robert Brooke, 33*li.* 6*s.* 8*d.* The rate of premiums was viii upon the hundred.

The insured came to his death on the 29 May, and intimation thereof was made to the underwriters severally. These latter refused to pay on the technical plea that the insured did live twelve full mouths, accounting after the rate of 28 days to every month. The Commissioners appointed in the City of London to determine such causes, and also Richard Chandler, the Clerk of Office of Assurance by whom the contract was drawn, determined that the contract was intended to continue in force for a whole year. It was in 1587 determined by two Judges of the Court of Admiralty, to whom the question had been judicially referred, that the underwriters must pay. This was undoubtedly a most just verdict. The age of the life insured is nowhere stated (*J.I.A.*, xvi, 423).

In 1622, Gerard de Malynes, merchant in London, published his famous work, *Vel Lex. Mercatoria, or the Antient Law Merchant, &c.*, which contains a chapter "Of the Office of "Assurances, and the antient custom of the same"; and the nature of the assurances there made is described in much detail. *Inter alia:*

"Other assurances are made upon the lives of men, for divers "respects: some because their estate is merely for term of life, "and if they should have children or friends to leave some part of "their estate unto, they value their life at so many hundredth "pounds; and if he do depart this life within that time the "assurers pay the money: as it happened of late that one being "engaged for, Sir Richard Martin, Knight, Master of the Mint, "caused 300 *li.* to be assured upon the life of the said Sir Richard, "being some 90 years of age, and therefore gave twenty-and-five "*per centum* to the assurers. The antient knight died within the "year, and the said assurers did pay the money.

"Also one Master Kiddermaster having bought an office of "the six Clerks of the Chancery, and taken up money of others, "caused for their assurance for many years together 2,000 *li.* to "be assured upon his life, after four and five in the hundredth, "until he had paid that money, which is very commodious."

It is clear that the first case here stated was one of Life Assurance, pure and simple. The rate of premium chargeable under the *English* Table (Healthy Districts) would have been £26. 15*s.*, without any loading for expenses; under the Institute of Actuaries' Tables (4 per-cent) £33. 14*s.* The second case cited was an insurance of the money sunk in the purchase of a *place for life*, the rate being £4 or £5 per £100—which was a very good one for a short-term insurance.

The author proceeds:—"Likewise a traveller undertaking a "voyage to Jerusalem or Babylon, delivering out money payable "at his return, will providently assure a sum of money upon his "life, either to secure some men that do furnish him with money "to perform his voyage, and to put forth the greater sum, or to "leave some means unto his friends if he should die and never "return."

Here is the earliest mention of Life Assurance being employed as a provision for families. The first portion of the paragraph is rather involved, and probably describes two modes of insurance practised at that period and long before: 1. A man going into foreign parts, say on a religious pilgrimage, having more money

than was required for his purpose, lent sums to his friends upon the condition that they paid, say, twofold on his return. They underwrote his life, to secure such a sum of money as would be required. 2. A merchant going on a trading expedition borrowed money of his friends upon the condition of repaying twofold the amount on his coming back. He might be required to insure a sum in case of his failure to return; or he might offer to do this himself, so as to secure the advance upon easier terms.

Malynes proceeds to laud the Office lending these facilities to merchants and others:

"So that this Office is most necessary in all human actions; "and men cannot invent or imagine anything but the value of it "may be assured, as you may judge from the former examples. "And herein must be noted that assurers are very fitly compared "unto orphans, because they may endure much wrong, but cannot "commit any; for they are to be ordered and commanded by the "Commissioners' sentence, and must perform the same: to which "end the Lord Mayor of London (for the time being) hath autho-"rity to commit them to prison, if in case they do not satisfy the "same within a limited time, until they do it."

It requires to be pointed out that the words "this Office", at the beginning of the preceding paragraph, no longer meant the "Chamber of Insurance" of 1574. This Chamber had now become the "Office of Assurance". *See later.*

It may be taken for granted that the usages for assurance described by Malynes were of long standing—that is to say, they had become customs. He had a large knowledge of mercantile affairs, and his work passed through many editions. I have here quoted from the first, but have modernized the spelling, in view of lessening obscurity. That he understood the necessary requirements of Life Assurance, from an underwriter's standpoint, is made clear by the following passage in Chapter 27, "Of the particulars "to be observed in Assurances":—"The assurance upon the lives "of men whether aged or young, of good qualities and diet, of "disposition, gentle or quarrelsome, a traveller or dweller, being "somewhat extraordinary, every man is best able to consider "it by the acquaintance of the persons". I think the word *extraordinary,* here used, is to be understood in the sense of *more special.*

Office of Assurances.—It will be convenient at this point to make some further reference to the functions of the "Office of "Assurance", which (as I have already intimated) had grown out

of the Chamber of Insurance of the preceding Century. We may again take Malynes for our guide:

"Whereas the policy of assurance remaining with the assured "is registered *verbatim* in the Office of Assurances, to the end that "if the same should happen to be lost, yet by the said register the "partie may recover of the assurers the several sums by them "assured. . . . .

"For by the custom of assurances it is intended that, to avoid "cavilations, every assurer should be bound *ipso facto* to the said "assurance, having a respect to the augmentation of trafficke and "commerce, according to the maxim, 'It is better to suffer a mis-"'chief than an inconvenience'; the mischief being attributed to "one or some particular persons, and the inconvenience to the "whole commonwealth in general. . . . .

"Hereupon the party assured doth procure his testimonials, "witnesses, or any other evidences concerning the said loss, de-"claring the manner, the place, the cause, with all circumstances, "either by examinations in the said Office of Assurances or in the "Court of Admiralty, with all such other proof as by letters and "all other means he can attain unto. . . . .

"The matter of loss being well examined and made plain, the "Commissioners then, with a mature deliberation, do set down "their determination and sentence: That the assurers shall pay "every one the money by him assured; and if thereupon any one "do deny to make payment accordingly, then (upon certificate of "the Lord Mayor of London and some of the said Commissioners "made of his refusal) they have by Act of Parliament (as aforesaid) "authority to commit the said assurer to prison, there to remain "until he do pay or satisfy the said sentence or final decree, which "no man of any credit will incur. And thus is this laudable "custom established in England; and beyond the seas they are "compelled by the magistrates to perform the like ordinances or "sentences pronounced in the like cases of assurances."

The judicial functions here referred to had been conferred upon the Court in 1601, under the authority of Statute 34 Elizabeth, chapter 12. Commissioners were thereby appointed to hear and determine disputes under policies of assurance; which Commissioners were to meet "weekly at the Office of Insurance on the west side of the Royal Exchange, for the execution of their Commissions, without fee or reward." The Lord Mayor was one of these Commissioners.

We shall very soon be introduced to some cases of Life

Assurances brought before this Court for determination. But it becomes necessary to record that later during this Century the practice of the Office underwent some change, the nature of which is set forth by Molloy in his *De Jure Maritima* (1676), as follows:

"Assurances are either public or private. *Public* when they are made and entered in a certain Office or Court called the Office of Assurance, on the Royal Exchange in London; and the same are called public for that it is free for any man to resort and see that another hath assured upon his adventure. *Private* is when an assurance is made, but the assured keeps the same secret, not deeming it fit that any should see or know their cargo or adventure, or what permis they have given or assurances they have made; and the same being never entered in the Office, is known by the name of a private assurance. By the Common Law they are both of the same validity, as in reference to obtain satisfaction from the insurers, if loss or damage shall happen to the adventure. But by the proceedings erected by the Statute 43 Elizabeth, c. 12, only those that are entered in the Office of that Court can be sued or determined there."

It is seen, by the phraseology employed, that marine insurance policies were mainly in contemplation. But Life Assurances were equally free to use the forms of the office, and machinery of the Court; and I have many reasons for believing they did so.

After the Great Fire of London in 1666—whereat I have assumed that the early records of this office were destroyed—the office was removed to Gresham House (*vide* Act for rebuilding this City); but probably it was much less resorted to than previously. It continued to exist: for in the *London Gazette* of 2-6 February 1720, there appeared an advertisement to the effect that fraudulent practices were suspected prejudicial to the Office; and information was invited. The establishment of Lloyd's Coffee House in 1710, and the establishment of Chartered Insurance Corporations in 1720, probably gave a final quietus to this formerly most useful Institution. The Policies of Insurance Court had indeed long previously found itself in conflict with the Superior Courts at Westminster.

In 1649 there came before the Court of King's Bench the case of Denoir *v.* Oyle, which throws some light upon the practice of the Courts regarding Life Assurance policies. A prohibition was prayed against the Policies of Insurance Court on the ground that its Commissioners were proceeding on the trial of the assurance of a man's life, which it was here contended was tryable at the common law, as it was before the Statute of Elizabeth (1601, which erected that Court) was made; and as indeed appeared by

the preamble of that Statute. Chief Justice Roll said that the assurance of the life of a man was not within the Statute, although a policy on a man's life on buying of an office was; but this case was different: for the man whose life was here assured, was going to sea upon merchant affairs; and his life might be as well assured as the safe return of the ship he was going in. But upon further hearing, a prohibition was granted. The simple fact was that the sureties (his bail) had insured the life of the captain to secure recoupment in case he did not return and surrender.—*Style's Reports,* pp. 166-72.

In 1690 there was before the Court of Chancery the case of Whittingham *v.* Thornborough, where the facts were these: the defendant Thornborough, had caused a policy of Insurance to be drawn for the assuring the life of one Edward Harwell for a year, and left it at the office of Samuel Luplow (probably an Insurance Broker), to get subscriptions at 5 per-cent premium; and in order to draw in the plaintiffs and others to underwrite the policy, procured one Marwood, a near neighbour of Harwell's, to underwrite £100; and he giving out that he knew Harwell to be healthy and likely to live, and the plaintiffs relying on such information, underwrote the policy—Mr. Whittingham for a £100, the other four for £50 a-piece. Harwell soon after died, a verdict had been obtained at law for the sums underwritten by plaintiffs.

It appeared at the hearing of the cause that Thornborough had no estate or interest that depended upon Harwell's life; that Marwood's subscription was only colourable, to draw in others, and that Harwell was in a languishing condition—though Marwood had pretended that he was a healthful man. The plaintiff on discovering the contrivance, tendered a return of the premium, and took steps to prevent others from being drawn in, as a large subscription had been designed. *It was given in evidence that the defendant had by a like contrivance secured a subscription of between one and two thousand pounds on an insurance on the life of William Sweeting.* The Court decreed that the policy should be given up to be cancelled; and granted a perpetual injunction against the verdict at common law. Full costs were given alike as to the action and this suit; the premiums received to be credited on account of such costs.—*Vernon's Chancery Cases,* ii, p. 205.

In 1693 that ingenious computer Leybourne, in his *Panarithmologia*—"a sure guide for purchasers, sellers or mortgagers of "land, leases, annuities, rents, pensions, etc., in present possession

"or reversion"—describing the branches of insurance, which then prevailed, said "Other assurances are made upon the lives of men "and women, at a rate that is moderate. For by this means, if "you buy any place or office that is worth £1,000 or more, or less, "and you have not money enough to purchase it, you borrow £400 "or £500. Now if you die, and are not in a condition to pay this "money, it is lost: but if you insure your life, then your friend "that you did borrow of will have his money honestly paid him." —P. 38, *Appendix.*

First Glimpses of Light.—Hitherto all had been all speculation and darkness. This new period takes its rise with the first efforts towards true light. But we must retrace our chronological record during the Century under review.

In 1698 an important point of Insurance Law was settled. A policy of £100 had been made on the life of Sir Robert Howard for one year from the day of the date thereof. The policy was dated 3rd September 1697, and Sir Robert died on the 3rd September 1698, about 1 o'clock in the morning. The underwriters refused to pay on the ground that the policy had expired. The Court held (1) that "from the day of the date" excluded that day, whereas the words "from the date" includes it, so that the day of the date was here excluded; (2) that the law makes no fraction in a day; yet in this, he dying after the commencement and before the end of the last day, the insurer was liable because the insurance was for a year, and the year was not complete until the day be ended. —Vide *Salkeld's Reports.*

2.—Speculative or Transitional Period.

It is one of the most remarkable features in the history of Life Assurance, that at the very moment when the business could, for the first time, have emerged from the reign of Experiment into the more satisfactory path of something like mathematical certainty—at that moment the course of events led it into a channel almost purely speculative. This was probably due to the temper of the times rather than to any other single cause. It is certain that the first step towards associated operation was intended to be respectable, although its basis was not very substantial; it is equally clear that the movement of 1706 was intended to be in the direction of permanence; but it will be made too apparent, as we proceed, that the very attractiveness of the features of the business seemed to render it the prey then, as it has done since, to a band of most

unscrupulous adventurers. It seems of the utmost consequence that the events of this period should be carefully surveyed: without this, no deductions can be drawn which will be permanently reliable.

The First Mutual Contribution Life Office.—The earliest project of associated Life Assurance was made in 1699. It was called "*The Society of Assurance for Widows and Orphans*". Its founder was Mr. Stansfeld, "at St. Austin's Gate, near the east end "of St. Paul's, London". The association was to consist, "when full", of 2,000 members, who were to contribute five shillings each towards every death that occurred among the members, this contribution being designed to raise £500 on the death of each member, contingent upon all members paying up. I will give a brief outline of the main provisions of its "Articles of Settlement".

The scheme was to commence as from 6th April 1699, to be kept in some public place in the City of London; two register books were to be provided and kept in the said office—one for entering the name and age of every subscriber, and the names and ages of his wife and children, or of any other person or persons to be provided for; and the other for entering the claim of every widow, or of every orphan or orphans, person or persons, made upon the Society, and the sum or sums of money paid upon every claim. These books to be open to the examination of subscribers. All claims and matters relating to the "Society" were to be heard and determined by thirteen persons, who were named, and who were all persons of good social position, as clergymen, &c. They were to be Trustees for the year. Any three of them might hold a "Court" for admission of subscribers, and any five of them for determination of other matters, being lawfully summoned by the "Master of the said Office". Vacancies might be filled. Trustees to be appointed every year by the votes of the subscribers.

Every subscriber on registering his name and the names of those for whose benefit the Assurance was to be made, was to pay 5*s*. for entrance, and 5*s*. more to meet the next claim; and should these have a policy under the seal of this office, nominees might be named, and from time to time changed, for all benefits under the policy. Policies might be changed on paying the cost of stamp. In case of death, *timely notice to be sent to this office, that its "Visitor" might see the person deceased.* An affidavit of death to be made by parties interested in the policy, supported by a certificate of death under the hands of the minister and churchwardens of the parish, or of three substantial housekeepers.

Persons on entering were to sign the deed, and within six months were to appear at the office before three or more Trustees, and have their policies approved and signed by the Secretary in their presence; at which Court every subscriber should, if required by the Trustees, or by the Master of the Office, produce *Certificate of his age,* and also an affidavit *that he had not any known distemper upon him, and that he was in a very good state of health,* and the Trustees should have power to refuse the person *if it appeared he was sickly and infirm,* or did not produce the Certificate, or that in any other respect he was not qualified for membership. Any person of the clergy or laity, "excepting such "as live in the marshy and unhealthy parts of England", might be admitted by proxy, if known to some of the Trustees, or to the Master of the Office, or to some two subscribers or substantial housekeepers living within the Bills of Mortality, as a person of good report; also not above 50 years of age, as also a Certificate signed by the ministers of three neighbouring parishes, testifying that they did believe him to be in health, and of such an age as he declared himself to be. All members being outside the Bills of Mortality to have a proxy to pay contributions and quarterages.

There was a stringent provision against *personation,* and in the case of persons who had become members becoming *soldiers and dying in warfare, or dying at sea, or in Foreign parts,* all interest in the Society and its funds was to be forfeited.

There were well-considered provisions for giving notice of and getting in contributions. On the death of any person after six months' membership, the Master to be ordered to pay £500, abating a proportionate amount if there were not the full 2,000 members; also deducting 3 per-cent towards defraying charge of office. The Master of the Office to settle the value of £1,000 in ground rents as guarantee of fidelity. The remuneration of the Master of the Office was to be 1*s.* quarterly from each subscriber, the 5*s.* entrance fee, and the 3 per-cent deduction from the death claim.

Any subscriber not paying contributions within seven days after notice to lose all benefit in his previous payments, and his policy to be cancelled. But members might by a deposit of money provide for future contributions, and have account rendered. Subscribers dying by hands of justice to forfeit all contributions made.

Mr. Stansfeld, the Master of the Office, was to have full power to control the office and regulate the staff; also to alter the regulations, subject to the approval of the Trustees.

The number of subscribers did not get completed very rapidly. In 1704 there were 600 members; in 1705 there were 908; in 1707 the number had increased to 1,104; and early in the working of the scheme the age of entry was reduced from 50 to 45. Notice of the change was given, with this further condition:—"When "the Society shall consist of 1,200, it is designed to be reduced to 40; when of 1,600, to 35; when it is full, to 30 years of age".

The following estimate of the supposed working of the scheme was published:

"The probable charge of this Society may be thus calculated: The number of people within the limits of the Bills of mortality are supposed by some to be 2 millions, by others 1½ million: by all to be at least a million: out of these there die about 20,000 a year, as appears by the general Bill of mortality, etc., which is 1 in 50, supposing the number of people to be 1 million. Now if but 1 in 50 dies out of the whole number, including women and children, sickly and infirm people, and such as are ancient and Decrepid, we may reasonably calculate that not above 1 in 50 shall die in our Society, which is to consist of such persons as are in health, and of the different ages above mentioned; and this is but 40 in 2,000—so that the probable charge when 'tis full, will be but £10 per annum, and while 'tis increasing in proportion to what it has hitherto done, the advantage must be very great. The Joint Stock is now about £220, and he that has been in from the begining has paid but £14."

The date at which this illustration was issued does not appear; but it was probably within five years of the start. There was another paragraph in the later prospectus from which I am now quoting which is important, as going to show that the scheme had the idea of Life Assurance as a family provision, an idea now but not originally implied. Thus:—"If the "Subscriber be a Clergyman that has a good liveing, or one "that has good business, or that has an office, whose salary and "perquisites are considerable, his family is morally secured of a "good subsistance. As long as the Subscriber lives they have "his income to depend upon, and at his death £500." And it added: "A jointure of £10 or £15 per annum is but a small "provision for a wife; but if such an Estate were settled to "maintain her title to the Joint Stock of this Society, when it is "full she will have, at her husband's death, £500, which will "purchase an Annuity of £50 per annum upon land security, "and free of all reprisals."

Among the early members were James Augustus Blondel, M.D.; John, Lord Bishop of Chester; also the Bishops of London, Gloucester, Llandaff, Oxford, Worcester; Edward Coke,

Gent., Sir John Cooke, Kt., LL.D.; Charles Davenant, LL.D.; Sir Wm. Duncombe, Bt.; John Exon, LL.D.; Bishop Floyd; Saml. Newton, Mathematician; Thomas Spurgin, "Embalmer"; and numerous Goldsmiths, Silversmiths, Merchants, Scriveners, and other persons of social distinction.

The office hours were from 9 till 12 and from 2 till 6, every day except holidays; Court days, the first and third Tuesdays in each month.

The forms to be filled up on applying for admission to this Association were the following, or their equivalents:

1. *Certificate of Age.*—We, ... Rector of . . . . in the County of . . . . . and . . . . . Vicar of . . . . . and . . . . . Curate of . . . . . in the County of . . . . . do well know . . . . . of the Parish of . . . . . in the said County, Gent. or . . . . . etc., and we do believe him to be in a good state of health, and of about the age of . . . years, and under the age of 45 years . . . .

2. *Affidavit.*—A.B., of . . . . . in the County of . . . . . Gent. or Yeoman, &c., make oath: That he, this deponent, to the best of his knowledge, is about the age of . . . . years, and under the age of 45 years, and that this deponent hath not any known distemper upon him, and that he is now in a very good state of health.

This Affidavit might be made before any Justice of the Peace.

There was no "Proposal Form" in the sense now understood.

The Form of *Policy* in use was as follows:

OFFICE OF ASSURANCE FOR WIDOWS AND ORPHANS. London, the . . day of . . . . 16 . . This Policy of Assurance is given unto . . . . . contributor to the Society of Assurance for Widows and Orphans, on the behalf of . . . . his now wife, and also on behalf of . . . . . his sons and daughters, or the survivor or survivors of them, upon the Joint Stock and Credit of the said Society, begun in London the 6th April, 1699, for payment of £500 of lawful money of England, unto . . . . . of the Parish of . . . . in the . . . . . of . . . . . for the use and benefit of . . . . . his now wife . . . . . sons and daughters of the said . . . . . or the survivor or survivors

of them, within two months after the death of the said. . . . now the husband of the said . . . . . and the father of the said . . . . . subject to the conditions and agreements mentioned in the Articles of Settlement of the said Society, agreed to and signed by the said . . . . . on the behalf of his wife and of his sons and daughters above mentioned: Provided that the said . . . . . is and shall be living at the end of six months, to be accounted from and after the . . . . . day of . . . . .

In Witness whereof the Seal of the said office is hereunto affixed the day and year first above written . . . . Registrar approved by the Trustees . . . . . Secretary.

This was the first of the *Mutual Contribution Life Offices.* It seems desirable to call attention to the fact that all the essential conditions of Life Assurance were here provided for. The lives were to consist of persons in good health, and not over a specified age; persons whose social position enabled them to be identified. Military, Naval and seafaring risks were excluded, and also deaths by the hands of justice. There was to be a probationary period (six months) within which if death took place there should be no claim. This last regulation was to compensate for the absence of medical examination—a practice introduced at a later date.

All these details, and indeed every incident connected with this pioneer Society, seems to be of great interest, not the less so that its very existence has heretofore escaped observation. In 1708, we learn from Hatton's *New View of London,* the office was held in Racquet Court, Fleet Street. The claims paid by the Society were advertised in the newspapers of the day. The first that is mentioned in the year 1707 realized £220. From Christmas, 1707, to Christmas, 1708, there died 24 members, and the amount collected realised £5,398. The payments to these varied from £221¼ to £225¾. It was made a regulation that all Subscribers pay 5*s.* within 7 days of the death of a Member, *in order to provide for the next claim.* Early in 1711 several claims were paid, among them one on the life of Sir Nathaniel Loyd, nominee of Sir John Cooke. But after this year we learn no more of this Society, except by way of postscript to an advertisement of the Amicable Society (1706), issued in March 1714: "Beware of Societies without a Charter; remember that of Racquet Court." But see 1712.

In the following year (1700) the same Mr. Stansfeld founded another and similar association, which became designated *The Second Society of Assurance for Widows and Orphans.* This was to consist of 1,000 members only, hence the sum to be raised on each death could not exceed £250. The entrance and other fees were to be less than in the other society. No claims were to be paid until "there be actually £250 in the joint stock". Operations were not to commence formally until there were 600 subscribers. The general regulations were much the same as in the former case; but the nominee feature was expanded, by adding powers for changing them, &c. The master of the office was to give security in ground rents to the value of £500, to secure a sum sufficient to have always £250 in hand to pay claims. The reasons for starting this second society are very obscurely stated—for instance, it was started to be a means to help to fill up the first! Strong inducements were held out to join early, as afterwards the younger ages would be selected in preference to the higher ones. It was thought some would join both. "The First Society, which has already made a considerable progress, has supply'd several widows, and is ready to answer all claims that may happen." Among the twelve promoters there were three Doctors of Divinity. The two societies worked on side by side for some years, and then suddenly disappeared from the scene—eclipsed, probably, by a later creation.

On the 8 November 1704 there was founded in London the "*New Assurance Office upon the Lives of Men, Women and Children,* established at the 'Bull and Dragon' (otherwise called Lincoln's Inn Eating-house), in Portugal Street, at Lincoln's Inn back gate." The advertisement issued by the promoters tells its own tale pretty fully, and says the institution is—

"Of that excellent constitution that by a man's assuring his Wife's life and his own, for the benefit of each other and their children, there will come into the family £500 upon the death of both of them, viz., £250 upon the death of the first, and the like sum upon the death of the other. The charge of each Subscriber will be 7*s.* 6*d.* paid down at subscribing (2*s.* 6*d.* thereof being to go towards paying the first claim) and after that paid out, then 2*s.* 6*d.* upon the death of every subscriber, and 6*d.* per quarter. A widow may assure in this office for the benefit of her children and grand-children; likewise any single man, or single woman, may assure upon any man, woman, or child's life, for his or her own benefit. And if a person whose life is assured, goes beyond sea, or into the wars, the life may be changed. The number of Subscribers are to be 2,000. The person's life to be insured is for the present year not to exceed 55; and none above 50

years of age to be admitted the next year; and no child's life is to be assured under the age of 12. By which assurance and the Articles hereunder written, it plainly appears how this office will greatly tend to the public good of mankind (and how charitable it is): for here the fatherless and widows may be relieved of their distress; a man may provide for his wife, and the wife for the husband; parents provide for their children, and children for their parents; and friends and relations for one another. The design is just and honourable; the benefits and advantages proposed certain; and the charge of each Subscriber but small and inconsiderable: which going out by little and little may easily be saved by the diligence and industry of some; as well as spent out of the common daily expenses of others." . .

Mr. Charles Pratt was appointed the master of this office, he being its founder. The internal regulations, as set forth in the Articles of Settlement, were on the same lines as those of this First Society, with a few modifications. The family-provision feature is here brought into more prominence. After a few years of working (precise date unrecorded) some supplemental regulations were made, amongst which was the following:

"*Item.*—That several people called *Quakers*, and others, being desirous of coming into this Society; but they not burying in Church Ground, are not willing to trouble the minister or church wardens for a certificate. Whereupon it is thought fit and agreed that for such persons a certificate of three or more substantial and creditable housekeepers of the parish where such Subscribers lived and died, shall be acquivalent with that of the minister and church wardens; and their solemn affirmation, or any other honest testimoney with that of an oath.

"*Item.*—That if any nominee, or person to be provided for, shall happen to die, or disoblige the Subscriber who assured for such person's benefit, such Subscriber may at pleasure deliver up and cancel his other policy, and have a new policy, upon paying only 1*s.* for stamps, and therein put other nominees or persons to be provided for; and so from time to time, as often as the Subscriber pleaseth, provided he or she hath the custody of the policy in his or her own power or keeping. But when such policy is made over in the name of a trustee, or wife and children, or as a jointure, or as security for any one for money lent or owing, in such case the policy is not to be altered without the consent of all parties.

"*Item.*—Whereas it have been objected that when a man hath been a Subscriber and Contributor to this Society for many years, and his occasions should call him in the war, or to go beyond the sea, and then he should die, the money he hath been out, and his interest in this Society would then be lost. It is therefore thought fit and agreed, that any Subscriber may at any time before he goes, cancel his policy and have a new policy, and put in the life of some other healthful person residing in England, not exceeding his own age, such as shall be approved by the Trustees or any three of them; and have a new policy again upon paying 1*s.* for the stamps, and so *toties quoties.*"

(To be continued.)

ACTUARIAL NOTES.

On the Value of the Option of Second Nomination in Reversionary Annuities. *By* GEORGE FRANCIS HARDY, F.I.A.

IT is the practice in some societies granting reversionary annuities to allow the substitution of another life should the original nominee die before becoming entitled to the annuity, a proviso being made that the life substituted shall not be younger than the nominating member, or that, if younger, certain fines shall be paid corresponding to the difference in age. The valuation of such annuities may therefore be considered to reduce, in practice, to the problem of finding the value of an annuity to y after x, with the proviso that, should y die first, another life equal in age to x may be substituted. There is clearly no theoretically accurate solution possible, except such as would involve immense labour. By a most happy coincidence, an extremely approximate solution can be obtained in the most simple terms, which I venture to think will be found of interest to readers of the *Journal.*

For the sake of illustration, the Carlisle Table at $3\frac{1}{2}$ per-cent may be employed, and, since the nominees are in general females, it may be assumed that a female life aged x would be equivalent to a male aged $x-4$. We may then write for this latter portion of the benefit,

$$\bar{A}^{1}_{yx} \times \mathring{a}^{(2)}_{x+t|x+t-4} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

where the second factor may be considered as a variable sum payable on the death of y before x, the amount depending on the age of x when that event shall occur. The above may be more conveniently written

$$= \left(1 + \frac{i}{4}\right) A^{1}_{yx}\, {}^{t}a_{x|x-4} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

If the assurance fall in during the 1st year, t may be taken on the average as equal to $\frac{1}{2}$; if during the second year, it will on the average equal $1\frac{1}{2}$; and so on. Hence (2) represents the value of the series (omitting the interest factor),

$$\frac{1}{l_{xy}} \left\{ v d_y l_{x+\frac{1}{2}} a_{x+\frac{1}{2}|x-3\frac{1}{2}} + v^2 d_{y+1} \cdot l_{x+1\frac{1}{2}} a_{x+1\frac{1}{2}|x-2\frac{1}{2}} + \&c. \right\} \quad . \quad . \quad (3)$$

Now if the values of $a_{x|x-4}$ be taken out for different values of x it will be found that at the younger ages, and in fact until some way beyond middle life, they are almost constant, but rapidly

diminish as the older ages are approached, in this respect suggesting a likeness to the probability of surviving short periods of years. On more closely examining this feature, similarity between these functions proved to be of a striking character, as will be seen by the following table, where col. 1 represents the age of x, col. 2 the value by Carlisle Table at $3\frac{1}{2}$ per-cent of the function $a_{x|x-4}$, col. 3 the value of the probability of a life aged x living 3 years multiplied by the arbitrary constant 4.

Carlisle Table, $3\frac{1}{2}$ per-cent.—Values of the Functions $a_{x|x-4}$ and 4_3p_x.

Age x (1)	$a_{x\|x-4}$ (2)	4_3p_x (3)	(3) − (2) +	−
30	3·59	3·69	·10	
35	3·63	3·68	·05	
40	3·66	3·64		·02
45	3·57	3·63	·06	
50	3·61	3·64	·03	
55	3·65	3·58		·07
60	3·58	3·41		·17
65	3·30	3·33	·03	
70	3·13	3·16	·03	
75	2·69	2·75	·06	
80	2·32	2·48	·16	
85	1·98	1·98		
90	1·60	1·45		·15

It will be seen at once that if in (3) we substitute for ${}^t a_{x|x-4}$ the function 4_3p_x, the resulting value of the expression would be practically unaffected; hence we may write for (3) the equivalent expression

$$\frac{4}{l_{xy}}\left\{vd_yl_{x+\frac{1}{2}}\cdot\frac{l_{x+3\frac{1}{2}}}{l_{x+\frac{1}{2}}}+v^2d_{y+1}l_{x+1\frac{1}{2}}\cdot\frac{l_{x+4\frac{1}{2}}}{l_{x+1\frac{1}{2}}}+\&c.\right\}$$

$$=\frac{4}{l_{x+3.y}}\cdot\frac{l_{x+3}}{l_x}\left\{vd_yl_{x+3\frac{1}{2}}+v^2d_{y+1}l_{x+4\frac{1}{2}}+\&c.\right\}$$

$$=4_3p_x\mathrm{A}^1_{y.x+3}\quad\ldots\ldots\ldots\ldots\quad(4)$$

The apparently intractable series (3) is thus evaluated, in terms of the most simple functions, by means of the entirely empirical though remarkably approximate relation exhibited above; the whole value of the benefit, namely, the reversionary annuity to y after x with permission to make a second nomination in case of y's premature death, being equal to

$$\frac{a_y-a_{xy}}{1+\frac{i}{4}}+4_3p_x\left(1+\frac{i}{4}\right)\mathrm{A}^1_{y.x+3}.$$

The life y being in general a female, account would of course be taken of this fact, as in the case of the second life x, by a similar deduction from the age.

The following table exhibits the degree of approximation obtained by using the formula, when x and y are of equal age: the errors would, of course, be similar in amount for other combinations of ages:

Age of x	True Value of Benefit, Series (3)	Value by Formula (4)
30	·748	·763
40	·833	·841
50	·896	·891
60	·961	·960
70	·912	·912
80	·643	·668
90	·620	·641
Average	·802	·811

Value of Endowment Assurance on Joint Lives.

[We have received from Mr. Davidson Walker, of 35, St. Andrew Square, Edinburgh, the following calculation, which may serve as a useful exercise to some of our younger readers.]—Ed. *J.I.A.*

TO find the single and annual premiums for an assurance payable on the failure of the joint lives of $A_{(30)}$, $B_{(33)}$, $C_{(37)}$, and $D_{(40)}$, or on D attaining the age of 60.

In order to find these premiums we must, as is well known, enter Orchard's Tables with the temporary annuity ${}_{|19}a_{30.33.37.40}$.

We have
$$
\begin{aligned}
{}_{|19}a_{30.33.37.40} &= a_{30.33.37.40} - {}_{19|}a_{30.33.37.40} \\
&= a_{30.33.37.40} - {}_{19}p_{30.33.37.40} v^{19} a_{49.52.56.59}
\end{aligned}
$$
and we find the values of $a_{30.33.37.40}$ and $a_{49.52.56.59}$ by Mr. Woolhouse's formula (*J.I.A.*, xi, 323),

$$a_{xy\ldots.} = n(V_n + V_{2n} + \ldots.) + \frac{n-1}{2} - \frac{n^2-1}{12}(\mu_{xy\ldots.} + \delta),$$

where $V_n = {}_n p_{xy\ldots.} v^n$.

Making $n=7$, and using H^M mortality and 4 per-cent interest, we have,

$$a_{30\cdot33\cdot37\cdot40} = 7(V_7 + V_{14} + \ldots\ldots) + 3 - 4(\mu_{30} + \mu_{33} + \mu_{37} + \mu_{40} + \delta)$$

$$\begin{array}{rl} V_7 = & \cdot57715 \\ V_{14} = & \cdot30542 \\ V_{21} = & \cdot13752 \\ V_{28} = & \cdot04532 \\ V_{35} = & \cdot00831 \\ V_{42} = & \cdot00048 \\ \hline & 1\cdot07420 \times 7 \\ \hline & 7\cdot51940 \\ & 3 \\ \hline & 10\cdot51940 \\ & \cdot29864 \\ \hline & 10\cdot22076 = a_{30\cdot33\cdot37\cdot40} \end{array} \qquad \begin{array}{rl} \mu_{30} = & \cdot00761 \\ \mu_{33} = & \cdot00823 \\ \mu_{37} = & \cdot00935 \\ \mu_{40} = & \cdot01025 \\ \delta = & \cdot03922 \\ \hline & \cdot07466 \times 4 \\ \hline & \cdot29864 \end{array}$$

$$a_{49\cdot52\cdot56\cdot59} = 7(V_7 + V_{14} + \ldots\ldots) + 3 - 4(\mu_{49} + \mu_{52} + \mu_{56} + \mu_{59} + \delta)$$

$$\begin{array}{rl} V_7 = & \cdot36803 \\ V_{14} = & \cdot08338 \\ V_{21} = & \cdot00726 \\ V_{28} = & \cdot00011 \\ \hline & \cdot45878 \times 7 \\ \hline & 3\cdot21146 \\ & 3 \\ \hline & 6\cdot21146 \\ & \cdot48120 \\ \hline & 5\cdot73026 = a_{49\cdot52\cdot56\cdot59} \end{array} \qquad \begin{array}{rl} \mu_{49} = & \cdot01494 \\ \mu_{52} = & \cdot01725 \\ \mu_{56} = & \cdot02197 \\ \mu_{59} = & \cdot02692 \\ \delta = & \cdot03922 \\ \hline & \cdot12030 \times 4 \\ \hline & \cdot48120 \end{array}$$

Multiplying this last value by ${}_{19}p_{30.33.37.40}v^{19}$, we get ${}_{19}a_{30.33.37.40} = 1\cdot01323$, and subtracting this result from the value of $a_{30.33.37.40}$ found above, we obtain, finally, ${}_{|19}a_{30.33.37.40} = 9\cdot20753$; and entering Orchard's Tables with this value, we have the single premium required $= 60\cdot741$, and the annual premium $= 5\cdot951$ per-cent.

NOTICES OF NEW BOOKS.

Memoir of Augustus De Morgan. By his wife, Sophia Elizabeth De Morgan. London: Longmans, Green & Co. 1882.

It is not fitting that a memoir of so distinguished a member of the Institute of Actuaries as the late Professor De Morgan should remain unnoticed in this *Journal;* and we are glad, therefore, to take an opportunity of calling attention to the work Mrs. De Morgan has produced, feeling sure that the discursive style of the writing will not be too severely judged by our readers, most of whom cannot fail to have some acquaintance with the original.

Augustus De Morgan was born in India in 1806. His father was an officer in the East India Company's Service, and his mother

was a grand-daughter of James Dodson, a mathematician of eminence, and the author of the *Antilogarithmic Canon.* After having happily escaped the dangers of an outbreak of native troops, he was brought to England when only seven months old. At the age of four he was "the victim of reading and numeration"; and after a course of study at various private schools in the West of England, where his mathematical abilities seem to have excited but little attention, he, in 1823, entered Trinity College, Cambridge, with the intention of qualifying for holy orders. His favourite and principal studies were mathematics, metaphysics, and mental philosophy; and in his leisure moments he sought recreation in music, of which he was passionately fond, and light literature of all descriptions. For out-of-door exercises and athletic pastimes generally, he had no taste, possibly because of a visual defect from which he suffered. He graduated in 1827, taking rank as fourth wrangler, and subsequently came to London with a view of prosecuting his studies for the bar,—the idea of ordination, as well as a transient fancy for the medical profession, having been abandoned. But law, too, was thrown over as readily as divinity and medicine, in the desire to support the newly-established University College, or, as it was then called, the London University, (the name was changed on the founding of the University of London in 1836); and, in 1828, De Morgan was unanimously selected, out of thirty-two candidates, to fill the mathematical chair. His inaugural lecture, "On the Study of the Mathematics", was delivered on 5th November of that year, and about the same time he published his first work, which was a translation of the first three chapters of Bourdon's *Algebra.* In 1831, however, in consequence of a difference of opinion with the governing body as to the proper position and independence of himself and his colleagues, he resigned his professorship. Going back a little in point of time, we should state that in 1828 De Morgan had become a Fellow of the Astronomical Society, which had been founded in 1820; and on the termination of his connection with University College, he was elected honorary secretary of that Society, and began those zealous and brilliant services which for many years afterwards he continued to render to astronomical science. His researches in this branch of study brought him into contact with many men of distinguished attainments, among the friends he now made being Francis Baily, Sir John Herschel, Mr. (Sir George) Airey, and Thomas Galloway, while Dr. Whewell (Master of Trinity) and Sir Frederick Pollock, (Lord Chief Baron) among others, were engaged in correspondence with him. From this time, besides the many mathematical works

he published, he was constantly writing articles for the *Penny Cyclopædia* (of which he contributed nearly one-sixth part of the whole), the *British Almanac and Companion*, the *Athenæum*, and various mathematical and scientific magazines, including this *Journal*. About this time, too, he was an unsuccessful candidate for the registrarship of the Amicable Assurance Society, Mr. Galloway being appointed to fill the vacancy. In 1836, Mr. White, who had succeeded De Morgan in his chair at University College, having been accidentally drowned, the latter offered his services temporarily in the emergency, and he was subsequently induced to return permanently to his old position, which he was not disinclined to do, as certain changes had been made in the rules of the institution with respect to the matters that were the cause of his previous resignation. In the following year De Morgan married a daughter of Mr. Frend, the first actuary of the Rock Life Assurance Company. Between this year and 1843, his time was fully occupied in his professional duties and miscellaneous writings. In the last-named year he joined the Committee of the Society for the Diffusion of Useful Knowledge (to whose transactions he had contributed three valuable works), which was broken up in the following year. He was also now much occupied in tracing the connection between mathematics and logic, and was earnest and assiduous in his efforts to promote the introduction of the decimal coinage, on what was then known as the pound-and-mil system, the principle of which was to maintain the pound as the standard unit, and divide it into decimal fractions.

De Morgan had now reached an epoch in his career when his numerous masterly contributions to science had become widely known, and were unsparingly recognized by the most eminent authorities of the time. As a mark of their appreciation of his great zeal and ability, the heads of the University of Edinburgh offered to confer upon him an honorary degree in 1859, but he declined the honour, as he "did not feel like an LL.D." In 1861 he severed his connection with the Astronomical Society, after splendid services extending over a period of thirty years, as a protest against tendencies he considered unconstitutional; but, shortly afterwards, he became the first President of the Mathematical Society, founded by his second son, the late George Campbell De Morgan, who had given ample promise of proving a worthy successor to his talented father. The last important event of public interest in De Morgan's life, was his resignation, for the second time, of his professorship at University College, in consequence of his belief that the College authorities had departed

from the principles of religious equality, on which the institution had been established. To this regrettable circumstance, both De Morgan and his widow attribute, in some measure, the illness which hastened his death; and there can be little doubt that, on a man of his nervous temperament, the mental agitation caused by such an occurrence must have exercised a most depressing influence. Augustus De Morgan died on the 18th March 1871, in the sixty-fifth year of his age; and thus was brought to an end a life of unremitting study, the results of which remain to enrich the literature of the sciences of which he was an ornament.

To this brief sketch of De Morgan's brilliant career it might be useful, did space permit, to add extracts from his writings in proof of his depth of thought and singular clearness of expression: his opinions, too, on the current topics of his time—such, for instance, as the desirability of competitive examinations—might be quoted with advantage, and would not fail to prove interesting. But though this is not feasible, we cannot omit mention of De Morgan's many disinterested services to young students, whom he never lost an opportunity of encouraging and assisting in all ways in his power. For the rest, we would refer our readers to the book itself, in which the full record of his life is set out; and though it may be thought that a widow is not, for many and obvious reasons, the best biographer of her deceased husband, they will not fail to enjoy the charming letters on all subjects, here reproduced, which are as full of learning and acuteness, as they overflow with genial humour.

A long list of De Morgan's writings is given at the end of the volume, and we annex a reference to a few of those which deal more particularly with life contingency matters, without mentioning many contributions to our own *Journal* and the *Insurance Record*:

Philosophical Magazine, 1839. On the rule for finding the value of an Annuity for three lives.

Ibid, 1841. Suggestion on Barrett's Method.

British Almanac and Companion, 1831. On Life Assurance.

Ibid, 1840. On the calculation of Single Life Contingencies.

Ibid, 1842. On Life Contingencies, No. 2.

Dublin Review, August 1840. On Legislation for Life Assurance.

Ibid, August 1841. Review of Jones on the value of Annuities.

Penny Cyclopædia. Articles—"Actuary", "Advowsons, value of", "Annuity", "De Moivre's hypothesis", "Interest", "Life, mean duration", "Reversion."

Essay on Probabilities, and on their application to Life Contingencies and Insurance Offices. (*Cabinet Cyclopædia*, small 8vo., 1838.)

C. D. H.

JOURNAL

OF THE

INSTITUTE OF ACTUARIES

AND

ASSURANCE MAGAZINE.

On the construction of Models of Policy-values, and on a new method of comparing the Reserves for Policies, according to different Tables of Mortality and Rates of Interest. By James Chisholm, F.I.A., *Manager and Actuary of the Imperial Life Insurance Company.*

[Read before the Institute, 26 Jan. 1885.]

THERE is no subject of greater importance in the conduct of the business of Life Assurance than that of the valuation of policies. It is a matter which comes before the actuary from day to day and from year to year, whether in the form of fixing the amount to be returned to an individual policyholder on the cancelment of his contract, or in that of estimating what reserve should be made in the aggregate for a mass of policies existing at the close of a valuation period. Both of these questions have been discussed before the Institute on many previous occasions, and it is not necessary to enter into them now. The task I have set before myself is the humbler one of dealing with results already arrived at. I do not propose to enquire what are the reasons for preferring one mortality table or rate of interest to another, or on what principle of calculation the surrender-value of a policy should be

based. I accept the results brought out by the use of any mortality table or rate of interest agreed on, and I propose to consider how these results may be represented by means of diagrams and models, and whether by this means we can arrive at any clearer understanding of the relation to one another of the reserves brought out by different standards of valuation.

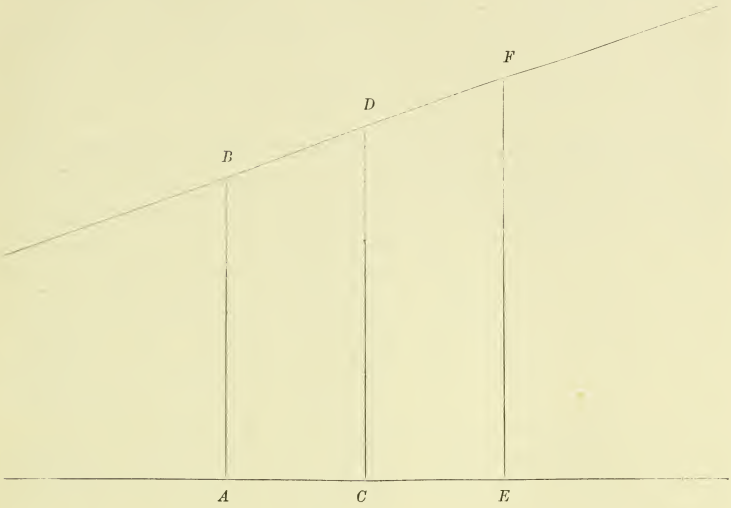
The simplest way in which policy-values may be represented pictorially is by means of lines or bars of definite length, and, in Diagram A, I have set down upright columns representing the values of policies at 3 per-cent interest according to the Northampton, Carlisle, Davies's Equitable, H^M, and H^M and $H^{M(5)}$ Mortality Tables for the following ages at entry and durations:

Ages at Entry	Durations
25 years.	5, 10, 15, 20, 25, 30, 35, 40 and 45 years.
35 ,,	5, 10, 15, 20, 25, 30 and 35 years.
45 ,,	5, 10, 15, 20 and 25 years.

A glance at the diagram shows us that the reserves on the H^M and $H^{M(5)}$ bases are far ahead of those given by the other Tables for all the ages at entry and durations set down. The Northampton, Carlisle, and Davies's Equitable reserves hold well together for all ages at entry until the common age of 55 is attained, and from this point the Carlisle reserve shoots suddenly ahead and occupies for the rest of its course a middle position between the Northampton and Equitable values on the one hand, and the H^M and $H^{M(5)}$ values on the other. The characteristics of mortality tables and the annuity-values deduced therefrom, which yield both large and small policy-reserves, have been fully entered into and discussed by Mr. Meikle in his paper "On Policy Life-Lines", published in 1871; and by Mr. Sprague in his two papers "On certain methods proposed for the valuation of the Liabilities of a Life Assurance Company" (*J.I.A.* xi, 90), and "How does an increased Mortality affect Policy-values?" (*J.I.A.* xxi, 77.)

I should state, at the outset, that throughout this paper the reserves referred to are those only which are based on a net premium system of valuation. The figures at the margin of the sub-divisions in the diagram for each age at entry give the numerical values of policies for 100, according to the several bases, and it will be noticed, how, for the longer periods of duration, the values of a policy of the same duration are distributed nearly over the whole space occupied in the diagram by the reserve for that period on the most stringent basis.

Diagram A, however, does not do more than contrast isolated policy-values on different bases with one another. If we wish to

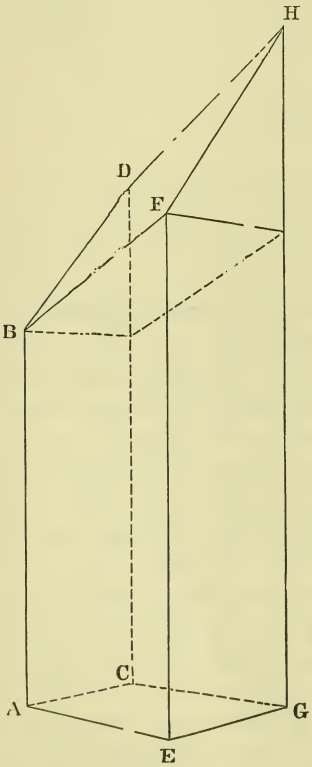


show the relation between policy-values of different duration, we must represent equal periods of duration by lines of the same length, running at right angles to the lines representing the policy-values; thus, in the annexed diagram, if the perpendicular lines, $A\,B$, $C\,D$, $E\,F$, represent the value of a policy of n, $n+1$ and $n+2$ years' duration, the horizontal lines $A\,C$, $C\,E$, will each represent periods of one year. The straight lines $B\,D$, $D\,F$, connecting the tops of the perpendicular lines, will represent the gradual growth of the policy-value from the end of one year to the beginning of another. This is represented by a straight line on the usual assumption, that over a period of a year a policy-value increases by equal increments in equal times, that is to say, in arithmetical progression. I have disregarded here the addition of π to the policy-value at the beginning of every year, because, by doing so, a model can be constructed much more simply, and for any interval of a year the exact policy-value can easily be found by the addition of the proper proportion of π.

On the usual assumption of an even distribution of deaths throughout the current year, we have the policy-value at the end of $n+\frac{t}{m}$ years (the premium due at the beginning of the year having been already paid),

$$
\begin{aligned}
{}_{n+\frac{t}{m}}V_x &= A_{x+n+\frac{t}{m}} - \pi_x\left(\frac{t}{m} + a_{x+n+\frac{t}{m}}\right)^{*} \\
&= A_{x+n+\frac{t}{m}} - \pi_x\left(1 + a_{x+n+\frac{t}{m}}\right) + \frac{m-t}{m}\cdot\pi_x \\
&= 1 - \frac{1 + a_{x+n+\frac{t}{m}}}{1 + a_x} + \frac{m-t}{m}\cdot\pi_x.
\end{aligned}
$$

We see from what precedes that the sum of the values of a policy for all possible durations, and for any particular age at entry will be represented by a plane, and thus we can construct any number of planes to represent the sums of policy-values for all durations for any ages at entry that may be required. If a complete series of these planes be arranged in parallel rows they will show the relation to one another of policy-values for all possible durations and ages at entry; and, in order that the idea we form may be a true one, each parallel row should be separated from the other by an equal distance, because each represents a series of policy-values, which at any given point of time is separated from the others adjacent by an interval of a year of age.



In the annexed diagram, *A B* represents the value of a policy effected at age x after n years' duration, *C D* represents the value of another policy effected at the same age after $n+1$ years' duration, so that the area *A B D C* will represent the sum of the values of

* NOTE.—If the first payment of an annuity on x be due at the end of $\frac{1}{m}$th, $\frac{2}{m}$th, $\frac{3}{m}$th, parts of a year, the approximate values are respectively, $\frac{m-1}{m} + a_x$, $\frac{m-2}{m} + a_x$, $\frac{m-3}{m} + a_x$, and generally, if the first payment be due at the end of $\frac{m-t}{m}$th parts of a year, the value will be $\frac{t}{m} + a_x$. (*J.I.A.* xiii, 189).

an infinite number of policies all effected at age x, and of all possible durations between n and $n+1$ years. In the same way the area $E\ F\ H\ G$ will represent the sum of the values of a similar number of policies for the same durations effected at age $x+1$. And as the line $A\ E$ represents every possible interval of age at entry between x and $x+1$, we see that the solid will represent the sum of a mass of policies effected at all possible ages at entry between x and $x+1$, and of all possible durations between n and $n+1$ years. In the same way another figure might be constructed representing ages at entry $x+1$ to $x+2$, and years of duration n to $n+1$, and these might be followed by other figures for all possible ages at entry and years of duration, until the limit of life was reached. And then, by aggregating all the figures together, we should have a representation of a model, in solid form, of all possible policy-values by any particular standard of valuation.

If solid blocks in wood or metal were cut in the form of the figures above described, we should be able to construct a complete model for any basis of valuation that might be desired. We might even cast the standards into the scales and weigh them in miniature, finding perhaps that the Northampton model weighed 10 lbs., the Carlisle model 11 lbs., and the $H^{M(5)}$ model 12 lbs. But the construction of models in this way would involve the expenditure of a considerable amount of time and labour. Even if ages at entry were taken only from age 20 to age 60 inclusive, and the limit of life were placed at 95 years the construction of 2,255 blocks would be necessary for each model, and each block would require four measurements to determine its height at the four angles.

Another much simpler method may be adopted which will yield results approximately correct and will furnish materials for the construction of any number of models on any basis.

We have the formula for the value of a policy

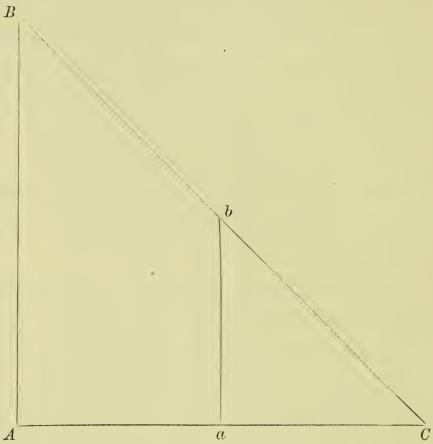
$$ {}_nV_x = 1 - \frac{1+a_{x+n}}{1+a_x} = \frac{a_x - a_{x+n}}{1+a_x} = \frac{\Delta a_x}{1+a_x}, $$

or, more generally, $$ V = \frac{\Delta a}{1+a}. $$

Hence, if we disregard the values of a and Δa given by any particular mortality table and rate of interest, and attach a series of arbitrary values within sufficiently wide limits to the numerator and denominator of the above fraction, we shall have a number

of values given to V which will be more or less close to the values on any particular basis according as the values of the numerator and denominator approach with more or less exactitude to the values of annuities and their differences on that basis.

A little consideration will lead to the conclusion that the assembled results for any variations in a and Δa that are required may be represented by a solid. If we suppose the value of the denominator $1+a$ to run from 25·00 by decrements of ·1 down to 1·00, we may set apart along the line $A\ C$ in the annexed diagram positions at equal distances for successive rows of perpendiculars parallel to $A\ B$, and representing the values of the fraction $\frac{\Delta a}{1+a}$ corresponding to each successive value of $1+a$. Thus the first row of perpendiculars would be set along the line $A\ B$, and if we assume that the value of the numerator Δa runs from 0· to 24· by increments of ·1, the value $\frac{0\cdot}{25\cdot}$ would be placed at the point A, and the value $\frac{24\cdot}{25\cdot}$ at the point B, while the intervening values would occupy the intermediate positions. In the same way the succession of values appertaining to the next denominator, 24·9, would be set in the following row, and so on.



The practical construction of a model on this plan would be a very simple matter. We know that the initial values along the line $A\ C$ in all the rows of perpendiculars are 0, because they represent the values of policies at successive ages just before payment of the first premium. The terminal value in each row will be the value given by the division of the limit of fall in the annuity-value by 1 + the initial annuity-value. Thus the succession of values in the row of perpendiculars set along the line $A\ B$ would be as follows:

$$\frac{0\cdot}{25\cdot}, \frac{\cdot 1}{25\cdot}, \frac{\cdot 2}{25\cdot}, \frac{\cdot 3}{25\cdot} \quad . \quad . \quad . \quad . \quad \frac{23\cdot 7}{25\cdot}, \frac{23\cdot 8}{25\cdot}, \frac{23\cdot 9}{25\cdot}, \frac{24\cdot}{25\cdot}.$$

We see that the values increase in arithmetical progression, and we can fix the values of the first and last terms. It is therefore only necessary to supply ourselves with the requisite number of rectangular bars of metal—brass will be best for the purpose—cut to a perfectly true edge and, say, $\frac{1}{8}$-inch square at the base, and after placing them in a line with their bases all in the same plane, have them cut along the top in a straight line between the value 0 at the beginning of the row and the value $\frac{\cdot 24}{\cdot 25}$ at the end. In the same way each succeeding row of bars might be cut, and the whole model built up very simply and easily. The difficulty in this case would arise from the great number of perpendicular bars to be kept in position and ready for use. To be of practical use the number of bars should be four times as many as would be produced by the above data; that is to say, we should have to make the values of both the numerator and the denominator in the above fraction, each vary by differences of ·05 instead of ·1. The resulting number of perpendicular bars on this basis would be more than 100,000, taking the entry-ages from age 20 only a little beyond age 60, and it would require a box measuring 5 ft. along one side, and 3 ft. 4 in. along another to hold them.

If such a model were constructed, each individual value being represented by a separate perpendicular in wood or metal that could be removed and replaced at will, it is evident that it would be, as it were, a storehouse model, from which the materials for building up other models of reserves, based on any table of mortality or rate of interest, might be drawn. To build up such a model, say for the H^M mortality at 3 per-cent interest, it would first of all be necessary to select along the line $A\ C$ the rows of perpendiculars having for their denominators the values nearest to those of the successive functions, $1+a_x$, $1+a_{x+1}$, &c., on that basis. Then, in each row, those values only should be selected which correspond to the successive falls, according to the selected table, in the value of the original annuity. Thus there would gradually be built up a model of the reserves of policies for all ages at entry and all durations (in yearly intervals of age and duration) by that particular table and rate of interest.

I exhibit a model (*vide* Plate following this paper) which has been made in one piece, and not by the building-up of a number of solid blocks. In order to construct this model, the elevations along the sides $A\ B$ and $B\ C$ in the last diagram were first calculated, that along the side $A\ C$ being $=0$; and a case in zinc was

made of the required size. The case was then filled with plaster of Paris, and the top surface smoothed off by drawing a straight-edge across the whole model, from and parallel to the elevation along the line *A B*. The length along each of the sides *A B* and *A C* is 12 inches, and the vertical scale has been exaggerated 10 times: the model thus represents the sum of the values of policies for 10.

Having now shown how to construct models of policy-reserves, let us see what can be learned from the models themselves.

If we make a section across such a model in the direction indicated by the line *a b* at a point corresponding to any particular age at entry, the area of that section will represent the sum of the values of policies of every possible duration at the common entry age; that is, it will represent, diagramatically, $\Sigma_n V_x$.

Diagram B has been constructed on this plan for age at entry 25, and the different lines running across the diagram represent the upper limits of the section according to the following bases respectively:

Carlisle	3	per-cent.
H^M	$3\frac{1}{2}$	,,
H^M and $H^{M(5)}$	4	,,
17 Offices	4	,,
American Experience . . .	$4\frac{1}{2}$	,,

The heavy line running across the diagram at some distance above the others shows pictorially the reserve made for policies on a life rated-up the 10 years when valuation is made at the rated-up age. It will be seen that there is no constant relation between the reserves on valuation at the actual age and at the rated-up age; and this comparison would at least indicate that the method of valuing at the rated-up ages can hardly be the correct one.

These sections suggest a new method of comparing the reserves brought out according to different bases of mortality and interest.

It is evident that if the function $\Sigma_n V_x$ were made the foundation of such a comparison it would lead to no useful result, for the weakness of the reserve at one part of a curve might be exactly balanced by a corresponding increase of strength at another part, and, the total $\Sigma_n V_x$ only being given, it would not be possible to make any correction for a different weight of observations at the respective deflections.

But if the function ${}_nV_x$ be summed for successive periods of duration of, say, 5 years, at selected ages of entry, the results

would afford a very useful means of comparing the relative strength of different bases of valuation reserves.

The subjoined table contains the values of $\Sigma_n^{n+5}V_x$ on the following bases, and at 3 per-cent interest, for age at entry 25, and durations in successive periods of 0–5, 5–10, &c., years, from the age at entry up to age 95, as a common limiting age:

Carlisle.
Davies's Equitable.
Seventeen Offices.
English Life Table, No. 3, Males.
Institute of Actuaries, H^M.
" " $H^{M(5)}$.
American Experience.
Thirty American Offices,

Sums of the Values of Policies for 100,000 *at risk during each period of* 5 *years—Interest* 3 *per-cent.*

Duration of Policies	Age at Entry 25 Years								Ages attained
	Carlisle	Davies's Equitable	Seventeen Offices	English Life Table No. 3 Males	H^M	H^M and $H^{M(5)}$	American Experience	Thirty American Offices	
0– 5	2,559	2,573	2,491	2,553	2,657	4,719	2,287	2,408	25–30
5–10	7,710	7,807	7,804	7,958	8,218	9,636	7,234	7,576	30–35
10–15	13,283	13,352	13,827	13,980	14,323	15,473	12,964	13,459	35–40
15–20	19,217	19,520	20,651	20,620	21,114	22,060	19,542	20,063	40–45
20–25	25,771	26,424	28,212	27,851	28,555	29,388	26,982	27,343	45–50
25–30	33,742	33,603	36,267	35,563	36,496	37,165	35,161	35,201	50–55
30–35	42,537	40,774	44,582	43,637	44,800	45,285	43,820	43,462	55–60
35–40	50,595	48,228	52,912	51,913	53,140	53,494	52,622	51,874	60–65
40–45	58,368	55,954	60,931	59,992	61,260	61,496	61,165	60,132	65–70
45–50	66,226	63,703	68 334	67,391	68,877	69,044	69,062	67,907	70–75
50–55	72,591	71,466	74,940	73,771	75,490	75,610	76,233	74,902	75–80
55–60	77,859	78,531	80,734	79,001	80,758	80,856	82,802	80,932	80–85
60–65	82,166	83,845	85,960	83,126	85,300	85,452	88,719	86,123	85–90
65–70	83,255	89,419	90,596	86,297	90,573	90,809	93,485	90,250	90–95
	635,879	635,199	668,241	653,653	671,561	680,487	672,078	661,632	

These values have been calculated by the formula

$$\Sigma_n^{n+5}|V_x = \left(1 - \frac{a_{x+n} + a_{x+n+5}}{2a_x}\right) \times 100{,}000.$$

We have taken the mean value between the policy-values at the beginning and at the end of each period, and that mean value has been multiplied by 100,000. In the particular case, for example, where $n=20$, and the calculation is made on the H^M $3\frac{1}{2}$ per-cent basis, we have found the area of the figure *D E F G* in Diagram B, and exhausted all the policy-values which it contains. This may be proved geometrically as follows:—Through the point *E* draw the line *E L* parallel to *D G*. Bisect

FL in H, and through H draw HK parallel to EL. Produce DE to K. Then the area of the figure $DEFG$ is equal to the area of the figure $DKHG$.

Of these two figures, the parallelogram $DELG$ is common to both, and the remainders $EKHL$ and EFL are equal to one another, because $EKHL$ is a parallelogram, and it stands on one half the base HL of the triangle EFL, and it lies between the same parallels (*Euclid* i, 41).

It has therefore been assumed that over any one period of 5 years the successive policy-values at equal intervals increase in arithmetical progression, and this assumption will be found to be very near the truth in most tables presenting a regular graduation, especially at those periods of age and duration where the weight of the observations falls heaviest.

A further use of values similar to those contained in the above table may consist in their application to purposes of valuation.

They are constructed on the foundation of a large number of policies effected at successive small intervals of time, and this is a theoretical condition which accords more or less with actual practice. It will also be found that under the conditions mentioned above, ${}_1V_{x-1}+{}_1V_{x+1}={}_1V_{x-2}+{}_1V_{x+2}={}_1V_x\times 2$ nearly. The age x may therefore be taken as the central one of the 5 consecutive ages $x-2$, $x-1$, x, $x+1$ and $x+2$, and the sums assured actually under observation may be grouped in the form

Duration of Policies.	Age at Entry.			
	18–22	23–27	28–32	&c.
Years. 0– 5 5–10 10–15 &c.				

A valuation by this method, although perhaps not sufficiently accurate to be made the basis for a division of profits, may still be very useful for many purposes. If the data are already recorded on cards so that they can be arranged in any way that may be desired, the work is so simple that it may be completed in a very short time. The method may therefore be used when great expedition is necessary; or it may be employed by Companies which make periodical investigations only once in 5 or 7 years to make approximate annual valuations to show how the business is

progressing; or, again, it may be useful in making a number of trial valuations on different bases when a Company desires to change its basis from one table of mortality or rate of interest to another.

In one respect the method is superior to the more accurate one of Class Valuation based on the formula

$$ {}_{n+\frac{t}{m}}V_x = A_{x+n+\frac{t}{m}} - \pi_x\left(\frac{t}{m} + a_{x+n+\frac{t}{m}}\right). $$

It enables us to hold a complete grasp of the facts in their proper relations. We see at once what parts of the business it is for which the largest reserves should be made.

In order to make a valuation on this plan reasonably accurate, it would be necessary (1) either that the business should be stationary in character, or that some allowance should be made to compensate for a larger mass of observations at the beginning of each quinquennial period; (2) that the central age in the group of observations should be the average age attained by all the lives.

This second condition may be provided for very simply if the facts be recorded on cards, and then be arranged according to years of birth, which run six months on either side of the date of valuation. Thus, if the valuation date be 31 Dec., the entrants should be recorded as born in successive calendar years between each 1 July and 30 June. It should be remembered also, that a valuation by the fo going method assumes the pure premiums valued to be those for the exact fractional age at entry.

Before bringing this paper to a close, I will with your permission give one or two other results I have arrived at in connection with the valuation of policies.

In valuing special policies at a valuation period, when the values of the Sum Assured and of the Premium are not required to be given separately, it is usual to take the mean value of each policy at the beginning and at the end of the current year of risk, and the valuation formula for an endowment assurance policy, for example, will be derived as follows:

$$ \left.\begin{array}{l}\text{Value at beginning of}\\ \text{current year, pre-}\\ \text{mium just paid. .}\end{array}\right\} = 1 - \frac{1 + {}_{|t-n}a_{x+n-1}}{1 + {}_{|t-1}a_x} + \pi_{x\overline{t}|}. $$

$$ \left.\begin{array}{l}\text{Value at end of current}\\ \text{year, premium just}\\ \text{due. . . . . .}\end{array}\right\} = 1 - \frac{1 + {}_{|t-n-1}a_{x+n}}{1 + {}_{|t-1}a_x}. $$

$$ \text{Mean value . .} = 1 - \frac{1 + {}_{|t-n}a_{x+n} + 1 + {}_{|t-n-1}a_{x+n}}{2(1 + {}_{|t-1}a_x)} + \frac{\pi_{x\overline{t}|}}{2}. $$

This is rather a cumbrous and a troublesome formula, and a much simpler mode of procedure may be adopted.

If we assume that the current policies are uniformly distributed over a year which begins 6 months before and ends 6 months after the date of valuation, so that the renewal dates fall in equal numbers on either side of the dividing line, we may make use of the unaltered formula $1 - \frac{1 + {}_{|t-n-1}a_{x+n}}{1 + {}_{|t-1}a_x}$, taking care only that the value given to n is the whole number less or greater than is indicated by the exact duration of the policy, according as the renewal date falls within the six months before or after valuation date, and adding one-half the current year's premium income.

In other words, one-half of the policies is valued by the formula $1 - \frac{1 + {}_{|t-n}a_{x+n-1}}{1 + {}_{|t-1}a_x} + \pi_{x\bar{t}|}$, and the other half by the formula $1 - \frac{1 + {}_{|t-n-1}a_{x+n}}{1 + {}_{|t-1}a_x}$.

When large numbers of policies are dealt with, and the amounts assured do not vary to any extraordinary degree, this is a mode of valuing special policies that may be legitimately adopted.

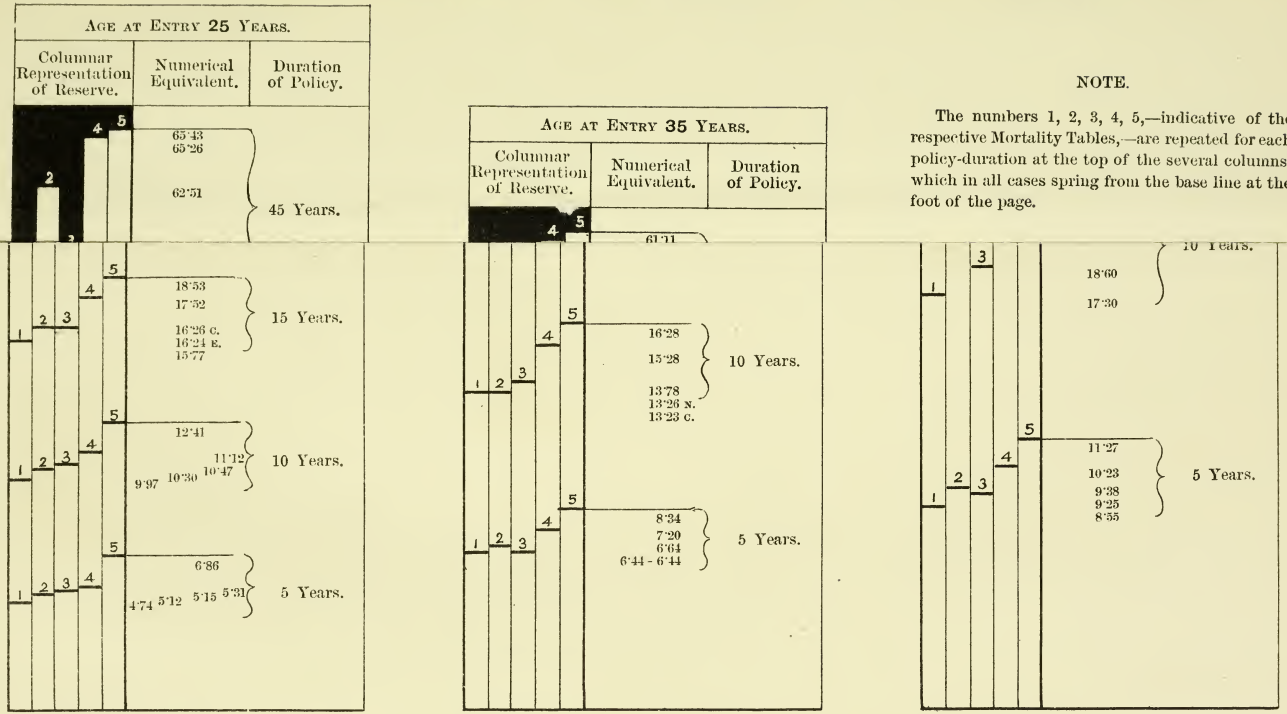
I had occasion some years ago to make a valuation of a number of endowment assurance policies, and I made use of both of the above methods. The following table, which contains the results, shows how comparatively trifling the difference is even when the policies fall in very unequal numbers on either side of the dividing line:

Policies Renewable during	No. of Policies	Sums Assured	Net Annual Premiums	Policy-Values	
				Method 1	Method 2
Six months before Valuation	34	15,027	619·21	1306·90	1018·25
" " after Valuation	16	4,700	126·72	464·97	520·27
	50	19,727	745·93	1771·87	1538·52
Add one-half total Annual Premium . . .				372·96	...
Add full Annual Premium on £15,027 . . .				...	619·21
Total Policy-Values				2143·83	2157·73

It has been usual in valuations to proceed on the assumption that the sum assured is payable at the end of the year, or on the

DIAGRAM A.

1. Northampton. 2. Carlisle. 3. Davies's Equitable. 4. H^M. 5. H^M & $H^{M(5)}$.

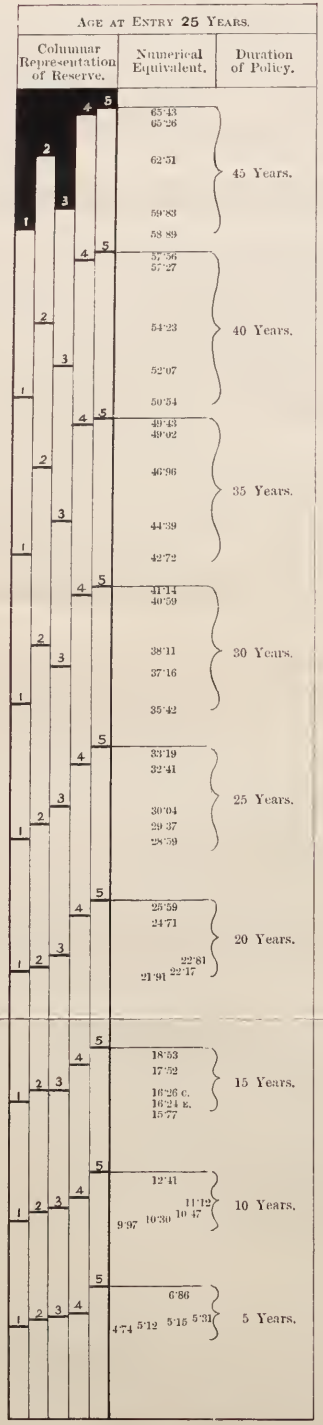


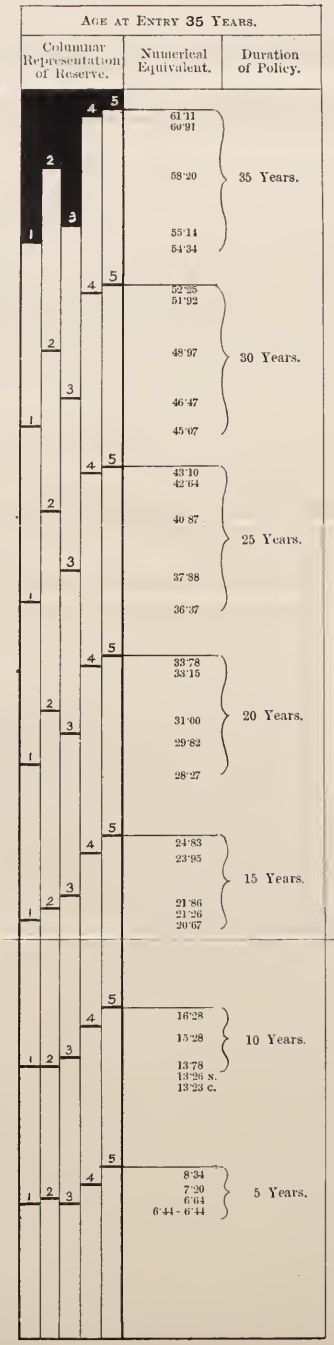
NOTE.

The numbers 1, 2, 3, 4, 5,—indicative of the respective Mortality Tables,—are repeated for each policy-duration at the top of the several columns, which in all cases spring from the base line at the foot of the page.

DIAGRAM A.

1. Northampton. 2. Carlisle. 3. Davies's Equitable. 4. H^M. 5. H^M & $H^{M(5)}$.





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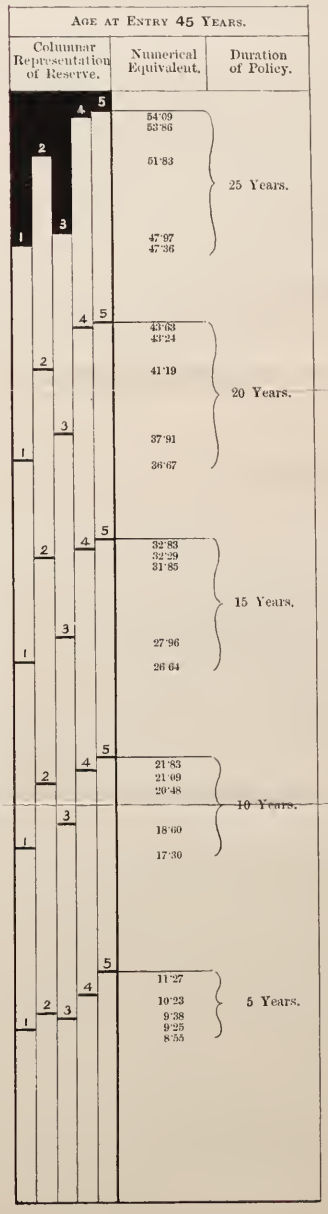
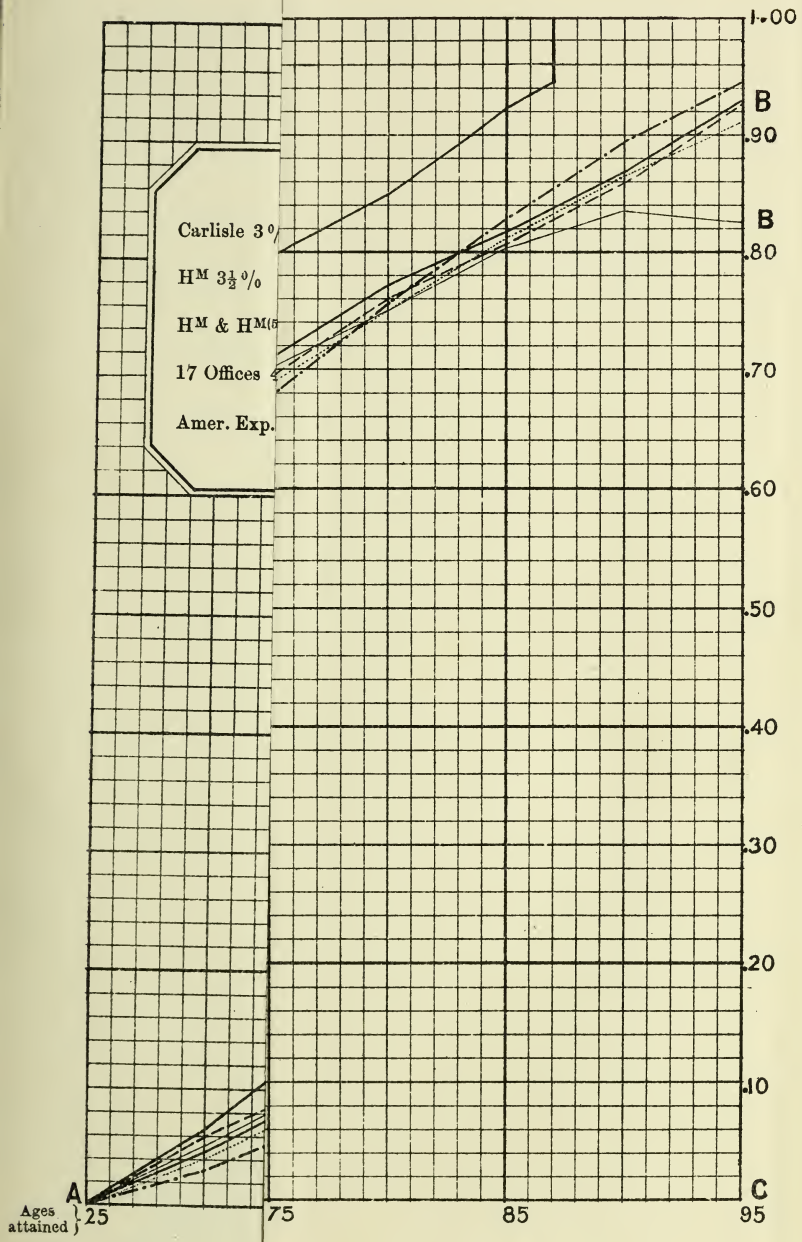
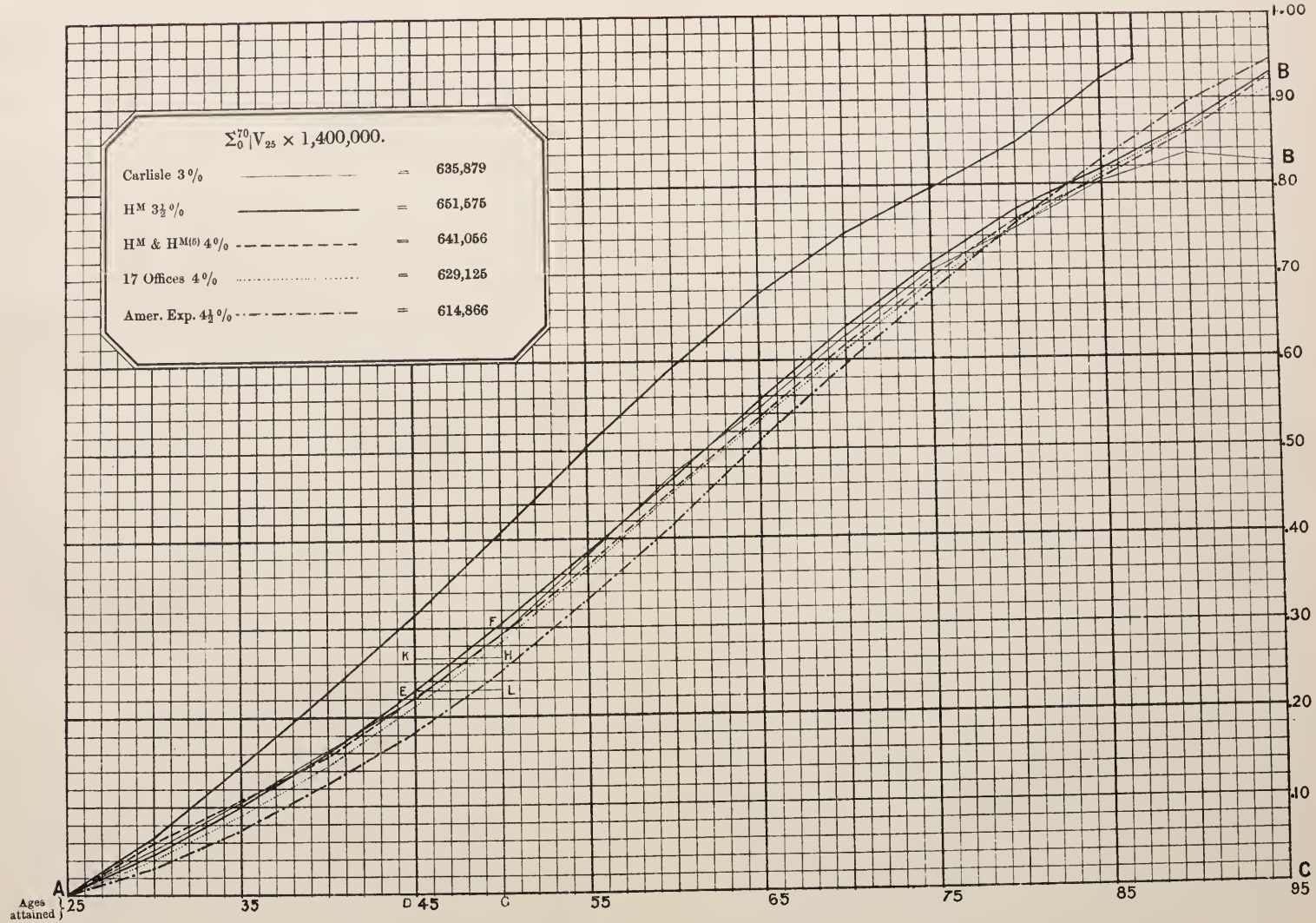


DIAGRA[illegible]ABLES OF MORTALITY AND RATES OF

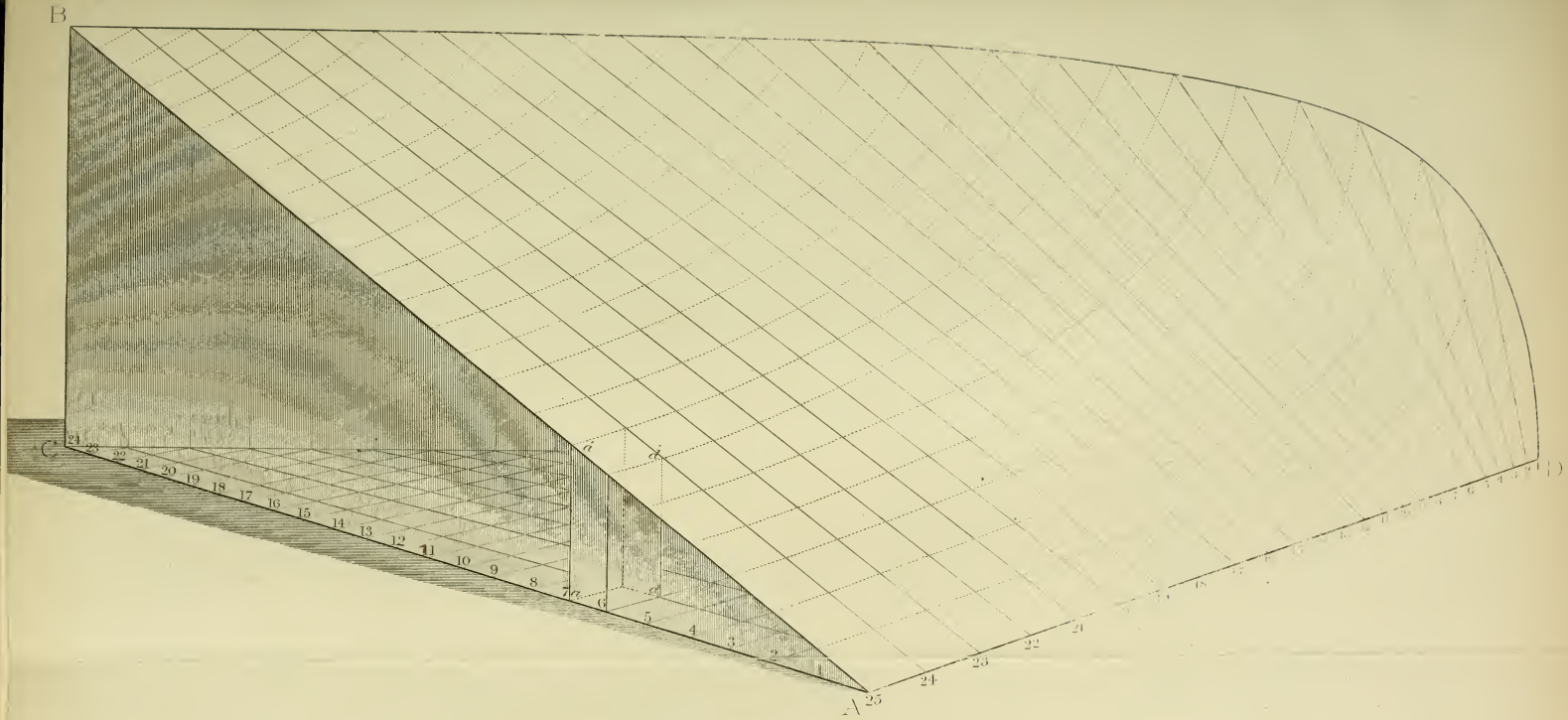


[illegible]present the policy-values.

DIAGRAM SHOWING THE AREAS, *A B C*, REPRESENTED BY $\Sigma_0^{70} V_{25}$, ACCORDING TO THE SEVERAL TABLES OF MORTALITY AND RATES OF INTEREST INDICATED.—(DIAGRAM B.).



NOTE.—The abscissæ represent years of duration at the respective ages attained, and the ordinates represent the policy-values.



Model representing the Sums of the Values of Policies of all Durations according to any Table of Mortality or Rate of Interest.

average 6 months after death; but as claims are now very generally payable either immediately or 3 months after death, it is desirable to enquire how this alteration in practice affects policy-values.

We have the single premium for an assurance payable 3 months after death $=1-d^{(2)}(\cdot 75+a_x)$, and for an assurance payable at death $=1-\delta a_x$ where $d^{(2)}$ is the interest on 1, accumulating by half-yearly rests in advance for a year, and δ is the interest accumulating momently in advance on 1 for a year.

Let $'A$, $'\pi$, $d^{(2)}$*, $'V$, and $\bar{A}$, $\bar{\pi}$, δ, $\bar{V}$, represent the altered values of A, π, d and V when the sum assured is payable 3 months after death and at death respectively.

We shall then have

$$
\begin{aligned}
{}_n{}'V_x &= ('\pi_{x+n}-'\pi_x)(1+a_{x+n}) \\
&= \left\{\left(\frac{1}{1+a_{x+n}}-d^{(2)}\frac{\cdot 75+a_{x+n}}{1+a_{x+n}}\right)-\left(\frac{1}{1+a_x}-d^{(2)}\frac{\cdot 75+a_x}{1+a_x}\right)\right\}\times(1+a_{x+n}) \\
&= 1-\frac{1+a_{x+n}}{1+a_x}+d^{(2)}\left\{\frac{\cdot 75+a_x}{1+a_x}(1+a_{x+n})-(\cdot 75+a_{x+n})\right\} \\
&= {}_nV_x+\frac{d^{(2)}}{4}\cdot\frac{a_x-a_{x+n}}{1+a_x}={}_nV_x\left(1+\frac{d^{(2)}}{4}\right).
\end{aligned}
$$

We see, therefore, that the difference between the reserve for a policy payable 6 months after death and the reserve for another policy payable 3 months after death is the value of a policy for one quarter of a year's interest, the reason being that, in the latter case, the risk is run every year of the sum assured becoming payable 3 months earlier than in the former case, and thus involving a loss of 3 months' interest.

It may also be shown in the same way and for a similar reason that

$$ {}_n\bar{V}_x={}_nV_x\left(1+\frac{\delta}{2}\right). $$

* An expression is often wanted for the nominal annual rate of interest, convertible m times a year corresponding to the effective rate i and *vice versâ*. The following is suggested as a complete scheme of notation.

PROPOSED SYMBOLS.

Discount Rates						Interest Rates				
Nominal	Effective					Nominal				Effective
d	$d^{(2)}$	$d^{(4)}$	$d^{(m)}$	$d^{(\infty)}$	$=\delta=$	${}^{(\infty)}i$	${}^{(m)}i$	${}^{(4)}i$	${}^{(2)}i$	i

Discount Rates					Interest Rates				
Nominal				Effective	Nominal	Effective			
${}^{(\infty)}d$	${}^{(m)}d$	${}^{(4)}d$	${}^{(2)}d$	d	i	$i^{(2)}$	$i^{(4)}$	$i^{(m)}$	$i^{(\infty)}$

But we also have, following the demonstration given by Mr. Sprague in the *Journal*, vol. xxiii, pp. 264, 265, ${}_n'V_x = {}'A_{x+n} - (1+a_{x+n})'\pi_x$, and ${}_n'V_x^{(4)} = {}'A_{x+n} - (\cdot 625 + a_{x+n})'\pi_x^{(4)}$

$$\therefore \quad {}_n'V_x^{(4)} - {}_n'V_x = (1+a_{x+n})'\pi_x - (\cdot 625 + a_{x+n})'\pi_x^{(4)}$$

$$= (1+a_{x+n})'\pi_x - \frac{\cdot 625 + a_{x+n}}{\cdot 625 + a_x}(1+a_x)'\pi_x$$

$$= {}'A_x\left(\frac{1+a_{x+n}}{1+a_x} - \frac{\cdot 625 + a_{x+n}}{\cdot 625 + a_x}\right)$$

$$= \tfrac{3}{8} \cdot {}'A_x \frac{a_x - a_{x+n}}{(1+a_x)(\cdot 625 + a_x)}$$

$$= \tfrac{3}{8} \cdot {}'\pi_x^{(4)} \cdot {}_nV_x.$$

Hence $$ {}_n'V_x^{(4)} = {}_n'V_x + \tfrac{3}{8} \cdot {}'\pi_x^{(4)} \cdot {}_nV_x,$$

and if we substitute for ${}_n'V_x$ its equivalent ${}_nV_x\left(1 + \frac{d^{(2)}}{4}\right)$ we have

$$ {}_n'V_x^{(4)} = {}_nV_x\left(1 + \frac{3}{8}{}'\pi_x^{(4)} + \frac{d^{(2)}}{4}\right).$$

It thus appears that the reserves for policies renewable oftener than once a year and payable at earlier dates than 6 months after death, may be stated in terms of the reserve for policies renewable by annual premiums and payable at the end of the year of death.

The subjoined table gives a conspectus of the various reserves in terms of ${}_nV_x$, when the sum assured is payable 6 months after death, 3 months after death, or at death, and when the policies are renewable yearly, half-yearly, quarterly, or momently.

Premiums Payable	Sum Assured payable		
	6 Months after Death	3 Months after Death	At Death
Yearly . . .	${}_nV_x$	${}_n'V_x = {}_nV_x\left(1 + \frac{d^{(2)}}{4}\right)$	${}_n\bar{V}_x = {}_nV_x\left(1 + \frac{\delta}{2}\right)$
Half-yearly .	${}_nV_x^{(2)} = {}_nV_x\left(1 + \frac{\pi_x^{(2)}}{4}\right)$	${}_n'V_x^{(2)} = {}_nV_x\left(1 + \frac{{}'\pi_x^{(2)} + d^{(2)}}{4}\right)$	${}_n\bar{V}_x^{(2)} = {}_nV_x\left(1 + \frac{\bar{\pi}_x^{(2)}}{4} + \frac{\delta}{2}\right)$
Quarterly . .	${}_nV_x^{(4)} = {}_nV_x\left(1 + \frac{3}{8}\pi_x^{(4)}\right)$	${}_n'V_x^{(4)} = {}_nV_x\left(1 + \frac{3}{8}{}'\pi_x^{(4)} + \frac{d^{(2)}}{4}\right)$	${}_n\bar{V}_x^{(4)} = {}_nV_x\left(1 + \frac{3}{8}\bar{\pi}_x^{(4)} + \frac{\delta}{2}\right)$
Momently . .	${}_nV_x^{(m)} = {}_nV_x\left(1 + \frac{\pi_x^{(m)}}{2}\right)$	${}_n'V_x^{(m)} = {}_nV_x\left(1 + \frac{{}'\pi_x^{(m)}}{2} + \frac{d^{(2)}}{4}\right)$	${}_n\bar{V}_x^{(m)} = {}_nV_x\left(1 + \frac{\bar{\pi}_x^{(m)} + \delta}{2}\right)$

It will be noticed that the policy-values resulting from the above variations in the terms of the contract, are the same as would arise from an increase of the sum assured under policies taken out on the original basis, that is to say, payable 6 months after death and renewable by annual payments.

Although the single premiums for a whole life and for an endowment assurance are based on the same argument, and although the valuation formulas for both kinds of assurance assume the same form, yet the modification in the policy-value, as shown above, found to be necessary when the premiums are payable otherwise than yearly, does not apply to endowment assurances.

We have $$A_x = A^{1}_{x\overline{n}|} + A_{x\overset{1}{n}|} = \frac{M_x - M_{x+n}}{D_x} + \frac{D_{x+n}}{D_x}$$

$$= A^{1}_{x\overline{n}|} = \frac{M_x}{D_x}, \text{ when } x+n = \text{the limiting age,}$$

and $$\pi_x = \pi^{1}_{x\overline{n}|} + \pi_{x\overset{1}{n}|}$$

$$= \pi^{1}_{x\overline{n}|}, \text{ when } x+n = \text{ the limiting age.}$$

We see, therefore, that when $x+n =$ the limiting age, the assurance values affected by the suffix $x+n$ vanish, and π_x also $= \pi^{1}_{x\overline{n}|}$. And as, in accepting half-yearly premiums, the risk run is that of the loss by death only during the currency of the policy of half a year's premium in every other case, the value of that loss at any particular epoch is, in the case of a whole-life policy, accurately represented by ${}_nV_x \times \frac{\pi_x^{(2)}}{4}$. But when we make the expiration of the term n fall within the limiting age, as in the case of endowment assurances, then the functions M_{x+n} and D_{x+n} are restored to vigour, and the value of the loss involved in accepting half-yearly premiums is represented by the first portion of the formula only. At any particular epoch this equals the then value of a temporary assurance, for the complete term, of one quarter's premium.

Discussion.

The Chairman (Mr. G. Humphreys) having invited observations,

Mr. George King said that Mr. Chisholm had shown them that they could put their mathematical formulas into geometrical form. The model referred to represented a double process of integration or summation, giving a solid representation of a large series of policy-

values; and Mr. Chisholm had explained how by means of such a model they could find policy-values. He had also presented a number of interesting diagrams, and had given ocular demonstration of a good many well-known facts. He would ask Mr. Chisholm to describe how he proposed to use the table (p. 149) giving the "sum of the values of policies for £100,000 at risk during each period of five years—interest 3 per-cent". He had explained that they could not take the totals at the foot of the various columns as showing the relative reserves of the company, because it was assumed that, for each age at entry and each duration there was the same number of policies in force. It appeared to be something like the hypothetical offices which had been brought before the Institute, but it did not make any allowance for the diminution of the amount at risk at the older ages, due to lapses and deaths. The method of obtaining an approximate valuation proposed by Mr. Chisholm might prove to be a useful suggestion, and might be frequently employed to give a hasty idea of what the office liability would be on any particular data. If the facts had previously been arranged suitably the work would by this method be very much abbreviated. They not only took the valuation at quinquennial intervals as regards present age, but also as regards ages at entry, and therefore it would reduce the work to about one-fifth. He did not agree with Mr. Chisholm with regard to the formula, which was said to be the ordinary method of valuing endowment insurances, and he did not think the suggested method would be shorter. He (the speaker) employed the following formula:

$$ {}_n\mathrm{V}_{x:\overline{t}|} = \mathrm{A}_{x+n:\overline{t-n}|} - \mathrm{P}_{x\overline{t}|}\left\{\frac{1}{2} + \frac{a_{x+n:\overline{t-n-1}|} + a_{x+n:\overline{t-n}|}}{2}\right\}, $$

where x was the original age, $x+t$ the age at which the endowment would mature, and $t-n$ the number of premiums still to pay. This did not do for any policy singly, but it was a suitable formula for periodical valuations. Where many policies had to be valued, a preliminary table of annuity-values should be prepared, which, for the Institute Experience, could easily be done by means of Mr. R. P. Hardy's tables of temporary annuities; but it was to be noted that for this purpose the annuity-values given by Mr. Hardy in his endowment assurance tables were unsuitable. He might point out that it was unfortunately common to value endowment assurance policies wrongly. Cases had come before him in which valuations had been made by adding $\frac{1}{2}$ to the annuity-values given in Mr. Hardy's endowment assurance columns, instead of using the interpolated annuity-values just explained. That made a difference in the valuation, all the more serious because the liability was under-estimated. With regard to the formulas at the end of the paper, for policies payable earlier than six months after death, he was pleased to see that Mr. Chisholm practically agreed with the principles he (Mr. King) laid down in his paper on "Benefits payable Fractionally" (*J.I.A.* xxiv, 418). He maintained that, mathematically, they must apply the correction to the reserves, and not the value of the reversion, and in that Mr. Chisholm agreed with him. He might point out that the various formulas in this portion of the paper were not rigidly accurate, but only rough approximations. Accurate formulas were given in his

(Mr. King's) paper. Mr. Chisholm's were the same in principle, but omitted certain terms.

Mr. G. H. Ryan thought attention would be chiefly directed to the short specimen table in which Mr. Chisholm showed the sum of the values of policies at 3 per-cent interest for £100,000 at risk during each age-period of five years. Mr. Chisholm proposed to use this practically by ascertaining the amounts insured (for each age at entry) at the specified durations, and then multiplying the sums at risk by the average reserves. The sum of these results would be taken, and that would give the total reserve of the office. But it would often be extremely difficult to arrange the amounts insured in such a manner that the full group could be taken, with any degree of closeness, to have reference to the reserves applicable for the fixed durations. The principle assumed in the method as suggested by Mr. Chisholm was, in fact, that the separate totals of the amounts insured would be at risk at the middle points of the groups of years of insurance. But it was not always safe to adopt the process of average unless the facts were fairly distributed over the whole duration; and seeing that this might not be the case with the sums at risk, he thought there might be some objection on theoretical grounds to adopting the method proposed by Mr. Chisholm. Mr. Chisholm had pointed out, with regard to the Carlisle Table and Davies' Equitable Table, that whereas, for age at entry 25, the aggregate reserves were virtually the same (assuming a uniform amount to be insured at each age) the reserves at certain age-periods were widely different. It had become more and more the custom not to regard with very great confidence mere aggregate results, but to investigate more closely the incidence of the observations at several points. For instance, when dealing with expected and actual deaths, the total expected deaths when compared with the actual deaths might often show a close approximation, but when analyzed for certain groups of ages marked divergence might appear, and the practical conclusions to be drawn from such divergences might be important. In Mr. King's paper on model office reserves (*J.I.A.* xx, 268), certain percentages were given representing the ratio of the aggregate liability brought out by several bases of valuation compared with a standard reserve—that of the H^M and $H^{M(5)}$ Tables. It would be interesting, as throwing a most instructive light on the internal movement of these (Mr. King's) tables, if they could see what the percentages were at the different periods of life. In recent investigations he (the speaker) found that, while the total reserves by two tables compared in a certain ratio, the relative reserves at various groups of ages were often different. That was an important matter, and it seemed to him very desirable that comparisons should be directed not solely between aggregate totals, but also, as far as possible, between the totals at several stages. He would suggest that it would have been an interesting addition to Mr. Chisholm's table if he had been able to include the reserves according to a select table of mortality for a common age at entry. Mr. Sprague had afforded them the means of supplying that omission, as had Mr. King also.

Mr. A. F. Burridge said that Mr. Chisholm had, doubtless, proposed to apply the table to which reference had been made as the basis of an interim valuation, which would serve as a guide between

two valuation periods. Such a valuation was, of course, more or less of an approximation; and he thought that Mr. Chisholm had been exposed to criticism in consequence of it being supposed that his table was to be applied to a particular and exact valuation. At the same time, he recognized the difficulty which Mr. Ryan had pointed out. He would suggest that probably the simplest method of making an interim valuation was by means of the valuation class-book: to take out the results in groups at quinquennial ages, and multiply the sums assured and the bonus by the value at the central age, and the premiums by the annuities at the central age. That was a useful and speedy method when a class-book was kept up year by year, and enabled them tc get a close approximation of the liabilities. In connexion with that, he would ask Mr. Chisholm whether by his method it would not be necessary to make an addition for the liability under reversionary bonus. The formula which Mr. King had suggested for the value of an endowment assurance, appeared to be identical with the well-known method, namely, take the valuation age as the age at the nearest birthday, and multiply the premium by an annuity-due, if the next renewal falls within six months of the date of valuation; or by an annuity of one more payment if the next premium is not due within six months. [Mr. King—That is the meaning of my formula.]

Mr. A. J. Finlaison remarked that in the ingenious diagrams Mr. Chisholm had exhibited, he had not alluded very prominently to the well-known divergences between the policy-values deduced from the Northampton and Carlisle Tables, but had dwelt more upon those brought out between the H^M and $H^{M(5)}$ Tables. He would ask Mr. Chisholm whether the divergence when the policies had subsisted for a very short period, and the agreement between the policy-values when the policies had been in force a great number of years, was not inherent from the construction of the tables themselves. The two tables of contrasted values were not the results of valuation throughout by the H^M and $H^{M(5)}$ Tables, but from what was termed a mixed valuation. In both cases the H^M net premium had been valued by the annuity according to the respective tables at the attained age as the asset, and the liability obtained from the values of the reversion also by the two different tables at the attained age. Now, there was a great number of entrants in the H^M Table at the younger ages, and consequently a marked difference between the H^M annuity-value and the $H^{M(5)}$ annuity-value; but at the older ages the entrants became few in number, with the result that there was but a small difference between the annuity-values of the two tables. Had the number of entrants even been uniform at all ages, or, as would be the case in a table constructed from the observation of life annuitants, increasing in numbers towards the older ages of the table, the divergence between the life annuity-values at the older ages in the H^M and $H^{M(5)}$ Tables would be more considerable. But, from the construction of the tables, it was not remarkable that the policy-values deduced from the two tables closely agreed where the duration was of a considerable number of years; because, in fact, an identical net premium was valued by what was practically the same annuity, and the liability in each case was assessed at practically the same amount, as the value of the reversion was, of course, dependent upon the annuity.

Mr. C. D. Higham remarked that it was well known how marvellously near the results of valuations made using quinquennial groups of ages approximated to the true figures; and he thought it would be less trouble to make a valuation in that way than in the manner suggested by Mr. Chisholm. He was surprised to find how little difference there was in the curves submitted by Mr. Chisholm between the H^M $3\frac{1}{2}$ per-cent line and the Seventeen Offices 4 per-cent. He should have thought the difference would have been greater. With reference to the remark of Mr. King, that in all cases claim acceleration reserve should be computed on the basis of liability instead of value of sum assured, Mr. King would remember certain offices to which that system was not applicable, but it was important to recollect that if the reserve was based on liability instead of value of sum assured the increased risk premium should be returned in the schedule to the Board of Trade. It was a manifest error to put into the schedule the ordinary risk premium and the interest on liability as an adjustment at foot, for it was only right that the actual risk premium taken credit for should be apparent, so as to make plain what margin there was for profit in the future.

The Chairman (Mr. G. Humphreys) having proposed a vote of thanks to the author,

Mr. Chisholm, in reply, said that the discussion had turned chiefly on the table on page 149, and in one or two cases it appeared to him that the use of it had not been quite understood. Mr. Burridge had suggested another method of making a trial valuation, but this was only applicable when the basis was the same as the original valuation. In making a series of valuations on new bases the first thing they would have to do would be to calculate the net premiums; but in his method they avoided the necessity altogether of calculating the net premiums or the loading, and the saving of labour in this way would be very great. The reserve would come out much about the same as on a detailed valuation; but it would be an approximate result, of course. He did not suggest the method as being adapted for accurate and scientific purposes, but as a check or a trial to find out which of three or four different bases they could select. He was of opinion that, for this purpose at least, it might be found to be of some value. The difficulty, as Mr. Ryan had said, was in the application to the observations themselves. It might happen that at the beginning of a period of five years there would be £100,000 at risk, when half through the period there might be £80,000, and at the end £70,000; and the sums at risk might vary very much during the period. It was of course necessary to make allowance for these variations. It would be necessary first of all to group the facts for each number of years' duration separately, and then see where the sums assured were above or below the average, and make some allowance for the deviation. The same kind of modification had to be made in using the ordinary system of class valuation. For instance, they did not always add half the premium income, but made an allowance in accordance with the incidence of the premium income throughout the year. They added to the reserve not half the premium income, but possibly two-thirds, and on the same principle it was necessary to make an allowance in dealing with the facts, when using the method he had suggested. With regard

to reversionary bonuses he had not touched upon them. It would be necessary to value the actual bonus at risk by the assurance value, but these bonuses being all grouped already according to years of birth, and no preliminary calculations having to be made for loading or net premiums, the process would be very simple. He quite agreed with Mr. King with regard to the endowment assurance formula. His (Mr. King's) method, of course, was very much better, for the reason that it gave the values of premiums and sums assured separately; and he only suggested his own as an improvement on one much more intricate, and when only the net result was required. Mr. Finlaison had, no doubt, explained the true reasons why the values by the H^M and $H^{M(5)}$ Tables approximated for periods of long duration.

On the Probability that a Marriage entered into at any age, will be Fruitful; and that, if a Marriage has been Childless for several years, it will afterwards become Fruitful. By THOMAS BOND SPRAGUE, M.A., *President of the Institute of Actuaries.*

[Read before the Institute, 23 Feb. 1885.]

IN December 1879 I read before the Institute a paper (*J.I.A.* xxii, 117) on the probability that there will hereafter be issue of a marriage hitherto childless. The statistics on which I based my conclusions, were those given by Dr. Matthews Duncan in his work, *Fecundity, Fertility, and Sterility;* and by Mr. Charles Ansell, Jr., in his *Statistics of Families of the Upper and Professional Classes.* But I was not altogether satisfied with the results I obtained; for, as I pointed out, the two sets of statistics differ from each other in some material respects, and I was unable to give any satisfactory explanation of the difference, or to say which set was the more trustworthy. For the purpose I had in view both sets had one great defect, namely, that they gave no information as to the number of childless marriages which corresponded to those that became fruitful at different intervals as stated in the tables. I have now, by means of a careful examination of the records of the British Peerage families, obtained a fresh set of statistics; and I purpose on the present occasion applying them to the solution of the same problem as I discussed in 1879.

My statistics relate to 1,522 marriages of peers and certain of their near male relatives, of which particulars are given in Lodge's Peerage for 1871. These marriages were, at the end of 1870, in very varied stages. Many had already been dissolved by the death of the husband or wife; and, of those which were still in existence, some had lasted for many years, while others had only taken place in the year 1870. By reference to the Peerage of 1884 I was able

to ascertain the result of each marriage up to the end of 1883; and I noted with regard to each of the 1,522 marriages, whether it had become fruitful or not. If it had, I noted in what year the first child was born; and if it had not, I noted whether it had been dissolved by death or divorce, or was a subsisting unfruitful marriage at the end of 1883. In the following table, the marriages are groupt according to the age of the husband at marriage; and it is shown how many of them took place at each decennial group of ages, and how many became fruitful; also how many unfruitful marriages were dissolved by the deaths of the husband and wife respectively, or by divorce, and how many were existing at the close of the observations.

TABLE A.—*Peerage Families.*

Husband's Age at Marriage	Number of Marriages	Of which became Fruitful		Unfruitful Marriages			
				Dissolved by			Existing at close of Observations
				Death of		Divorce	
		Number	Per-centage	Husband	Wife		
16–29	806	678	84	28	28	5	67
30–39	457	363	79	26	22	1	45
40–49	151	101	67	18	5	2	25
50–59	65	33	51	16	5	...	11
60 & upwards	43	7	16	24	6	2	4
TOTAL	1,522	1,182	78	112	66	10	152

In only about one-third of the marriages was I able to ascertain the age of the wife, and it was therefore necessary to group the marriages, as above, according to the age of the husband. But since it is a rare thing for a young man to marry a woman past childbearing age, we may, I think, assume without risk of any sensible error, that the wives of all the men under the age of 40 were young women. It will be seen from the above table that of the 1,522 marriages, 1,182 (or 78 per-cent) resulted in the birth of issue; also that the proportion of the marriages which become fruitful, depends on the age of the husband at marriage, gradually decreasing from 84 per-cent for husbands under 30, to 79 per-cent when the husband is between 30 and 40, 67 per-cent when the husband is between 40 and 50, 51 per-cent when the husband is between 50 and 60, and 16 per-cent at 60 and higher ages. When I wrote my former paper, I had not been able to obtain any trustworthy statistics bearing upon this point; but such inform-

ation as I could obtain, seemed to indicate that the probability of a marriage being unfruitful was between 20 and 25 per-cent, and I therefore made my calculations upon the two suppositions—(1) that the probability was 20 per-cent, (2) that it was 25 per-cent. According to the present statistics, the proportion of unfruitful marriages when the husband is under 30, is only 16 per-cent; and when he is between 30 and 40, 21 per-cent. This percentage is an important element in the calculation of the probability we are seeking; and I believe that my present statistics determine it with great accuracy, and that therefore the conclusions based upon them are much more trustworthy than those which I formerly obtained. The following Table (B) shows in more detail

Table B.—*Peerage Families.—Marriages groupt according to Husband's Age.*

Year after Marriage	Ages 16–29					Ages 30–39					Ages 40–49					Ages 50–59					Ages 60 & upwards					Year after Marriage
	Became Fruitful	Unfruitful Marriages				Became Fruitful	Unfruitful Marriages				Became Fruitful	Unfruitful Marriages				Became Fruitful	Unfruitful Marriages				Became Fruitful	Unfruitful Marriages				
		Dissolved by			Existing at close of Observations		Dissolved by			Existing at close of Observations		Dissolved by			Existing at close of Observations		Dissolved by			Existing at close of Observations		Dissolved by			Existing at close of Observations	
		Death of		Divorce			Death of		Divorce			Death of		Divorce			Death of		Divorce			Death of		Divorce		
		Husband	Wife				Husband	Wife				Husband	Wife				Husband	Wife				Husband	Wife			
1	292	2	2	..	...	155	1	5	...	...	47	3	...	...	...	9	2	1	...	...	3	1	...	...	...	1
2	256	1	...	...	...	142	1	1	...	...	33	1	...	...	...	15	2	...	...	...	3	...	...	...	...	2
3	72	3	2	...	...	34	2	2	...	...	11	...	...	...	...	7	...	...	...	...	...	2	1	...	...	3
4	16	1	...	...	...	14	...	...	...	...	2	...	...	...	...	1	...	...	...	...	1	...	...	1	...	4
5	13	...	2	...	...	3	1	1	...	...	3	...	...	...	...	...	1	1	...	...	...	1	2	...	...	5
6	5	2	2	...	...	5	1	...	...	...	1	1	2	...	...	1	...	1	...	...	...	...	1	...	...	6
7	5	1	2	...	...	4	1	1	...	...	...	...	...	...	...	...	1	...	...	...	...	2	...	...	...	7
8	4	1	1	2	...	1	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	1	...	...	8
9	1	...	...	...	...	1	3	1	...	...	1	1	...	...	...	...	...	...	...	...	...	1	...	1	...	9
10	3	...	...	1	...	1	...	...	...	...	1	...	1	...	...	...	1	...	...	...	...	2	1	...	...	10
11	5	...	1	...	...	1	2	2	1	...	...	2	...	...	...	...	...	...	...	...	...	1	...	...	...	11
12	1	1	2	...	...	...	1	1	...	...	...	...	2	...	...	...	2	1	...	...	...	1	...	...	...	12
13	2	...	...	...	3	1	1	1	...	1	...	...	...	1	1	...	1	...	...	...	...	1	...	...	2	13
14	...	2	...	1	5	1	2	...	...	...	...	1	...	...	1	...	1	...	...	...	...	2	...	...	...	14
15	...	1	1	...	3	...	1	1	...	...	...	...	...	1	1	...	...	...	...	...	...	...	...	...	...	15
16	2	2	4	...	1	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	2	...	...	...	16
17	1	2	...	...	1	...	...	...	...	3	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	17
18	...	2	1	...	1	...	...	1	...	1	...	1	...	...	2	...	...	...	...	2	...	4	...	...	...	18
19	...	2	1	...	...	...	...	...	...	...	...	1	...	...	...	...	2	...	...	...	...	2	...	...	...	19
20	...	1	2	...	1	...	1	1	...	1	...	3	...	...	1	...	...	...	...	...	...	1	...	...	...	20
21	...	...	1	...	...	...	...	...	...	3	...	...	...	...	1	...	1	...	...	1	...	...	...	...	1	21
22	...	2	1	1	2	...	2	...	...	4	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	22
23	...	1	1	...	2	...	1	3	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	23
24	...	1	1	...	...	...	1	...	...	...	...	2	...	...	...	...	...	...	...	2	...	...	...	...	...	24
25	...	...	1	...	48	...	3	1	...	32	...	1	...	...	17	...	...	1	...	5	...	...	...	...	1	25
Totals	678	28	28	5	67	363	26	22	1	45	101	18	5	2	25	33	16	5	...	11	7	24	6	2	4	Totals

the result of each group of marriages. It gives, for each year after marriage up to the 25th, the number of marriages in the group, which became fruitful in the year; the number of unfruitful marriages which were dissolved either (1) by the death of the husband, or (2) by the death of the wife, or (3) by divorce; and, lastly, the number which were still in existence as unfruitful marriages at the close of the observations.

Thus it appears that, out of the 806 marriages of men under the age of 30, 292 became fruitful (or in other words issue was born) in the first year following the marriage; in 2 cases the husband died, and in other 2 cases the wife died, during that first year. In the second year, 256 marriages became fruitful by the birth of a first child, and one marriage was dissolved by the death of the husband. As the most recent marriages included in the observations, took place in the year 1870 and were traced up to the close of the year 1883, it follows that no marriages are entered in the table as existing until we come to the 13th year, at the end of which year there are 3 marriages subsisting.

It will be convenient now to compare my statistics with those of Dr. Duncan and Mr. Ansell. The former gives certain particulars relating to 3,722 fruitful marriages, these being arranged according to the mother's age at marriage. The latter gives certain particulars as to 6,035 fruitful marriages, but his table affords no information as to the age of either husband or wife. As already mentioned, my statistics relate to 1,522 marriages, of which 1,182 were fruitful. In every case the age of the husband can be determined from the dates given in the Peerage; but in only 498 cases was I able to ascertain the age of the wife. Having regard to these circumstances, I will first, for the purpose of comparison with Mr. Ansell's figures, group Dr. Duncan's figures and my own, without regard to age. This is done in the following Table (C).

Table C.—*Showing the number of Marriages, according to different Observations, that became Fruitful at various intervals after Marriage.*

Year after Marriage	Number of Marriages becoming Fruitful in each Year			The same out of a total of 1,000 Fruitful Marriages			Year after Marriage
	Duncan	Ansell	Sprague	Duncan	Ansell	Sprague	
1	608	3,159	506	163·3	523·4	428·1	1
2	2,390	2,163	449	642·1	358·4	379·9	2
3	437	421	124	117·4	69·8	104·9	3
4	133	137	34	35·8	22·7	28·8	4
5	61	69	19	16·4	11·4	16·1	5
6	32	26	12	8·6	4·3	10·2	6
7	27	21	9	7·3	3·5	7·6	7
8	12	11	6	3·2	1·8	5·1	8
9	5	7	3	1·3	1·2	2·6	9
10	5	7	5	1·3	1·2	4·2	10
11	1	5	6	0·3	0·8	5·1	11
12	3	4	1	0·8	0·7	0·8	12
13	4	3	3	1·1	0·5	2·5	13
14	2	2	1	0·5	0·3	0·8	14
15	...	...	...	...	...	...	15
16	1	...	3	0·3	...	2·5	16
17	...	...	1	...	...	0·8	17
18	...	...	...	...	...	...	18
19	1	...	...	0·3	...	...	19
Total	3,722	6,035	1,182	1,000·0	1,000·0	1,000·0	Total

It appears from this table that the 3,722 marriages included in Dr. Duncan's observations, became fruitful by the birth of a first child as follows:—608 in the first year after marriage, 2,390 in the second year, 437 in the third, and so on. In order to show more clearly the relation of the different figures, I have in the second part of the table reduced proportionately the figures belonging to each set of observations, on the assumption that there were exactly 1,000 marriages in each.

Examining first the years immediately following marriage, it will be observed that there is a remarkable difference between the three sets of statistics. In my former paper I said: "According "to Dr. Duncan's statistics, for one first child that is born during "the first year of marriage, 4 are born during the second; "whereas, according to Mr. Ansell's statistics, the number of such "children born in the first year, is greater than in the second year "in the ratio of about 3 to 2." As regards this point, my statistics are intermediate between the other two sets, but more nearly resemble those of Mr. Ansell; the number of marriages which became fruitful in the first year being greater than those

that became so in the second, but only exceeding them by about 10 per-cent. As it seems probable that this difference may depend upon the age of the wife at marriage, I now give the following Table (D), which contains certain information as to the 498 marriages in which I was able to ascertain the age of the wife. It shows how many of those marriages took place at each age; how many of them became fruitful; and in how many the first child was born in each of the six years immediately following marriage, and at a later period.

TABLE D.—*Peerage Families.—Marriages groupt according to Wife's Age.*

Wife's Age at Marriage	Number of Marriages	Of which became Fruitful	Became Fruitful in Year							Wife's Age at Marriage
			1	2	3	4	5	6	Subsequently	
15	4	4	1	3	...	...	...	...	...	15
16	2	2	...	1	...	...	...	...	1	16
17	10	10	2	5	2	1	...	...	...	17
18	42	38	15	18	4	...	1	...	...	18
19	51	42	16	14	7	1	1	1	2	19
20	59	55	22	28	2	2	...	1	...	20
21	47	42	21	17	2	1	1	...	...	21
22	45	34	18	11	2	...	...	...	3	22
23	46	38	16	15	3	1	1	...	2	23
24	39	33	15	11	3	1	1	1	1	24
25	22	20	13	3	2	...	...	...	2	25
26	24	21	11	3	5	2	...	...	...	26
27	15	12	7	4	1	...	...	...	...	27
28	18	14	8	4	1	...	...	...	1	28
29	13	10	3	4	1	...	...	1	1	29
30	14	11	5	5	1	...	...	...	...	30
31	6	5	4	1	...	...	...	...	...	31
32	8	6	4	1	...	1	...	...	...	32
33	2	...	...	...	...	...	...	...	...	33
34	4	2	...	1	1	...	...	...	..	34
35	1	...	...	...	...	...	...	...	...	35
36	2	2	2	...	..	...	...	...	...	36
37	7	4	...	2	1	...	...	1	...	37
38	3	1	1	...	...	...	...	...	...	38
39	2	...	...	...	...	...	...	...	...	39
40	...	...	...	...	...	...	...	...	...	40
41	1	1	...	1	...	...	...	...	...	41
42	...	...	...	...	...	...	...	...	...	42
Above 42	11	...	...	...	...	...	...	...	...	Above 42
Total	498	407	184	152	38	10	5	5	13	Total

The greatest number of marriages took place at the age of 20, and at this age there were 59, of which 55 became fruitful. In 22 cases the first child was born within a year after marriage, in 28 within the second year, in two cases within the third year, and so

on. The numbers at individual ages are too small to give a satisfactory indication of a law. Grouping them, therefore, we get the results shown in the following Table (E):

Table E.—*Summary of Table D.—Peerage Families.—Marriages groupt according to Wife's Age.*

Wife's Age at Marriage	Number of Marriages	Of which became Fruitful		Became Fruitful in Year							Wife's Age at Marriage
		Number	Percentage	1	2	3	4	5	6	Subsequently	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	
15–16	6	6	100	1	4	...	...	...	...	1	15–16
17–19	103	90	87	33	37	13	2	2	1	2	17–19
20–22	151	131	86	61	56	6	3	1	1	3	20–22
23–25	107	91	85	44	29	8	2	2	1	5	23–25
26–28	57	47	82	26	11	7	2	...	...	1	26–28
29–32	41	32	78	16	11	2	1	...	1	1	29–32
33–37	16	8	50	2	3	2	...	...	1	...	33–37
38–42	6	2	33	1	1	...	...	...	...	...	38–42
43–	11	...	...	...	...	...	...	...	...	...	43–
Total	498	407	82	184	152	38	10	5	5	13	Total

Here column (2) shows the number of marriages which took place in the different groups of ages specified in column (1). Column (3) shows how many of these became fruitful, and column (4) the percentages which the fruitful marriages were of the total at each group of ages. Columns (5)–(11) show the distribution of the fruitful marriages according to the year in which the first child was born. Thus, taking the ages 20–22, the table informs us that 151 marriages took place, of which 131 or 86 per-cent were fruitful; that in 61 cases the first child was born within the first year following marriage, in 56 within the second, and so on. It will be observed that column (4) shows a remarkably regular progression, the probability that a marriage will be fruitful decreasing continuously as the age at marriage increases; the decrease being very slow up to about the age of 30, and then much more rapid.

In Table (F) the same figures are reduced to percentages. It shows for each group of ages (1) the percentage of the marriages which became fruitful in each of the three years immediately following marriage, and (2) the corresponding percentages of the total marriages. I have not thought it necessary to give any figures relating to the 4th and subsequent individual years, because the actual numbers are so small that no useful or trustworthy conclusions can be drawn from them.

TABLE F.—*Peerage Families.—Marriages groupt according to Wife's Age.*

Wife's Age at Marriage	Percentage of Fruitful Marriages which became so in Year					Percentage of Total Marriages which became Fruitful in Year				
	1	2	3	1–3	Subsequently	1	2	3	1–3	Subsequently
15–16	17	67	..	84	16	17	67	...	84	16
17–19	37	41	14	92	8	32	36	12	80	7
20–22	47	43	4	94	6	40	37	4	81	5
23–25	48	32	9	89	11	41	27	8	76	9
26–28	55	24	15	94	6	46	19	12	77	5
29–32	50	34	6	90	10	39	27	5	71	7
33–37	25	38	25	88	12	12½	19	12½	44	6
38–42	50	50	...	100	...	16	17	...	33	...
43–	...	...	...	...	...	...	...	...	...	...
	45	38	9	92	8	37	30	8	75	7

According to this table the proportion of the marriages which became fruitful in the first year, steadily increases until we reach the ages 29–32; and the proportion which becomes fruitful in the second year, almost as steadily diminishes. It seems a fair inference that the deferment of the birth of the first child beyond the first year, must to a very great extent depend upon the circumstance that in many cases the wives have not arrived at full maturity at the time of marriage.

Treating Dr. Duncan's figures in a similar way, we get the results shown in the following Table (G), where it is to be observed that, as the statistics relate only to fruitful marriages, we have no figures showing the percentages of the total marriages that became fruitful.

TABLE G.—*Births in Edinbro and Glasgow.—Births of First Children groupt according to Mother's Age at Marriage.*

Wife's Age at Marriage	Became Fruitful in Year					Percentage of Fruitful Marriages which became so in Year				
	1	2	3	Subsequently	Total	1	2	3	1–3	Subsequently
15–19	94	409	83	63	649	14	63	13	90	10
20–24	325	1,259	202	119	1,905	17	66	11	94	6
25–29	126	533	88	62	809	15	66	11	92	8
30–34	44	135	45	27	251	17	54	18	89	11
35–39	15	49	17	15	96	16	51	18	85	15
	604	2,385	435	286	3,710	16	64	12	92	8

The figures in the second part of Table (G) are to be compared with those in the first part of Table (F). Considering the first and second years after marriage, and excluding ages 15 and 16 in my table, at which there were only 6 marriages, it will be seen that there is an entire want of agreement between the two tables. While, according to my figures, the percentage of the marriages becoming fruitful in the first year, increases with great regularity up to nearly the age of 30; in Dr. Duncan's figures, there is no similar increase, but the proportion becoming fruitful in the first year after marriage is approximately constant for all ages. Having regard to the regular progression shown by my figures, and their general agreement in the aggregate with Mr. Ansell's, I believe that my results are more trustworthy than Dr. Duncan's; and I am inclined to suspect that there must have been something in the manner of collecting his statistics, which has led to an error as regards the first year after marriage. If, for instance, only the calendar year of marriage and the calendar year of the birth of the first child were noted; and those cases where the two years were identical, were taken as corresponding to the birth of the first child within a year after marriage; while those cases where the child was born in the calendar year after marriage, were taken as indicating births in the second year after marriage; the result would be to make the figures run in the same way as Dr. Duncan's actually do.

In connection with this point, it may be useful to quote the following passage from Mr. Sadler's *Law of Population*, Vol. 2, p. 30: "Married females do not become fruitful, on the "average, during the first year of their nuptials, but nearly so. "A great number of cases which I have collected with the "view of determining this point, give three-fourths of them as "producing their first child at the average of one year after "marriage." It is not quite clear what we are to understand by this statement. Since three-fourths (or 75 per-cent) of the wives produce their first child at an average of one year after marriage, it is to be presumed that one-half of this number, or 37½ per-cent, produce their first child after a less time than a year from the date of marriage. It is not stated, however, whether the three-fourths are calculated upon all the wives, or only upon the fruitful wives. If the latter is the case, then, out of a total of 1,000 fruitful wives, there are 375 whose first child is born within a year of marriage, against 428 given by my statistics, 523 by Mr. Ansell's, and 163 by Dr. Duncan's. If, however, the three-fourths

are calculated upon the total marriages (as seems, for the reason to be mentioned directly, the more correct course), we obtain 483, as follows: According to my statistics, out of 1,522 marriages, 1,182 became fruitful, so that the total number of marriages corresponding to 1,000 fruitful marriages is 1,288; and 37½ per-cent of this is 483. Whichever figure we take, we see that Mr. Sadler's statement agrees fairly well with the statistics of Mr. Ansell and myself, and is quite at variance with Dr. Duncan's. In another passage (Vol. 2, p. 238), Mr. Sadler says: "In again "referring to a register of the peerage which I have formed, with "a view to the determination of this and many other interesting "questions, I find that two-thirds (very exactly) of the marriages "produce a birth each before the termination of the year follow-"ing that in which they take place." As no figures are given, the meaning of this passage also is very obscure; but, reading it in the light of my own results, I understand it to mean that two-thirds of the total marriages became fruitful within two years after the date of marriage; and this closely agrees with my own conclusions. Taking husbands of 16–29, there were 806 marriages; and 548 of these, or 68·0 per-cent, became fruitful within two years: for husbands of 30–39, the percentage was 65·0; for husbands of all ages, 62·7; and for wives of all ages, 67·5. Comparing the two passages, there seems no doubt that the three-fourths of the former passage is calculated on the fruitful wives, and the two-thirds of the latter on the total wives.

Passing on now to the years more remote from the date of marriage, the following Table (H), in which the results of Table (C) are arranged in three groups of years, exhibits a still more important difference between my statistics and the others.

TABLE H.—*Summary of Table C.*

Years after Marriage	Number of Marriages becoming Fruitful in each Period			The same out of a total of 1,000 Fruitful Marriages			Years after Marriage
	Duncan	Ansell	Sprague	Duncan	Ansell	Sprague	
1– 5	3,629	5,949	1,132	975·0	985·7	957·8	1– 5
6–10	81	72	35	21·7	12·0	29·7	6–10
11–	12	14	15	3·3	2·3	12·5	11–
Total	3,722	6,035	1,182	1,000·0	1,000·0	1,000·0	Total

We see from it that, whereas out of 1,000 fruitful marriages of which the particulars were collected by Dr. Duncan and Mr. Ansell, there were only 3 and 2 respectively in which the birth of

the first child was delayed more than 10 years after marriage, this was the case in no less than 12 out of 1,000 marriages among the British Peerage families included in my observations. It seems useless to attempt any conjectural explanation of this circumstance: but I think there can be no doubt that, for all business purposes; such as the calculation of premiums of insurance against issue; or the calculation, for disentail purposes, of the probabilities of future issue; my statistics will form a much more suitable and safe basis of calculation than either of the others.

If we consider now the extreme length of time after which any of the marriages became fruitful, we observe from Table (B) that, of 806 marriages entered into by men under 30, 1 became fruitful in the 17th year after marriage; of 457 at ages between 30 and 40, 1 became fruitful in the 14th year; and of 151 at ages between 40 and 50, 1 became fruitful in the 16th year. Turning now to Table (C), we find that in Dr. Matthews Duncan's statistics there was one case among 3,722 fruitful marriages, of the first child being born in the 19th year after marriage; while Mr. Ansell's statistics showed no case among 6,035 such marriages, of a first child being born after the 14th year. Having regard to these figures, I have assumed that it is impossible that a first child should be born after a marriage has subsisted more than 20 years. It is right to state, however, that Dr. Matthews Duncan, in his *Sterility in Woman*, p. 114, mentions a case in which a lady became pregnant for the first time 22 years after marriage, and had a living, healthy child at the age of 42.

I now proceed to calculate, by means of the particulars given in Table (B), the probability that a marriage which has endured for a number of years without issue being born, will afterwards become fruitful. Taking the husbands whose ages were 16–29 at marriage, the last year in which, according to our observations, any marriage became fruitful, is the 17th after marriage; and at the end of that year the number of the marriages considered that were still subsisting, was 74. Our observations include, however, 12 childless marriages which had lasted at the close of the observations for a less time than 17 years, namely, 3 for 13 years, 5 for 14, 3 for 15, and 1 for 16; and it is possible that one or more of these might become fruitful during the four years between the end of the 13th and the end of the 17th after marriage. In the first instance we will make the calculation on the assumption that none of these 12 marriages will become fruitful, but that they will all be subsisting unfruitful marriages at the end of the 17th year; and the effect of this assumption is to increase, from 74 to 86, the number

of unfruitful marriages still subsisting at the end of the 17th year. Adding to these the one marriage which became fruitful in the 17th year and the two which were dissolved during the year, we get 89 as the number of unfruitful marriages subsisting at the beginning of the 17th year after marriage. Adding to these the 2 marriages which became fruitful in the 16th year, and the 6 which were dissolved, together 8, we get 97 unfruitful marriages subsisting at the beginning of the 16th year; and proceeding in this way, addition from the bottom upwards gives us the number of unfruitful marriages subsisting at the beginning of each year, as shown in column (4) of Table (I), where the number (806)

TABLE I (*deduced from Table B, p.* 162).—*Peerage Families.—Husband's Age at Marriage* 16–29.

Year after Marriage	Unfruitful Marriages					Applying the Correction explained on p. 172, we get the following Figures in place of those in Columns			
	Became Fruitful in the Year	Dissolved	Subsisting at beginning of Year	Of which subsequently became Fruitful	Probability of Marriage becoming Fruitful	(2)	(4)	(5)	(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	292	4	806	678	·841	292	806	678·34	·842
2	256	1	510	386	·757	256	510	386·34	·758
3	72	5	253	130	·514	72	253	130·34	·515
4	16	1	176	58	·330	16	176	58·34	·331
5	13	2	159	42	·264	13	159	42·34	·266
6	5	4	144	29	·201	5	144	29·34	·204
7	5	3	135	24	·178	5	135	24·34	·180
8	4	4	127	19	·150	4	127	19·34	·152
9	1	0	119	15	·126	1	119	15·34	·129
10	3	1	118	14	·119	3	118	14·34	·121
11	5	1	114	11	·096	5	114	11·34	·099
12	1	3	108	6	·056	1	108	6·34	·059
13	2	0	104	5	·048	2	104	5·34	·051
14	0	3	102	3	·029	0·1	102	3·34	·033
15	0	2	99	3	·030	0·1	98·9	3·24	·033
16	2	6	97	3	·031	2·1	96·8	3·14	·032
17	1	2	89	1	·011	1·04	88·7	1·04	·012
	678	...	...	...	...	678·34	...	...	...

opposite year 1, is the total number of marriages that took place at the ages in question. Summing the numbers in column (2) from the bottom upwards, we get the total numbers of marriages that became fruitful after the lapse of different intervals. Thus, 1 marriage became fruitful in the 17th year; 3 in the 16th and subsequent years; 5 in the 13th and subsequent years; 6 in the 12th and subsequent years; and so on, as shown in column (5). Then dividing the number in column (5) by the number in column (4), we get the probability shown in column (6). Taking, for example,

the figures opposite year 10, we learn that, at the beginning of the 10th year after marriage, there were 118 unfruitful marriages subsisting; and that 14 of these subsequently became fruitful; so that $14 \div 118 = \cdot 119$, is the probability that a marriage which has endured for 9 years without the birth of issue, will subsequently become fruitful.

We have now to make a correction on account of the above-mentioned 12 marriages. There were 3 marriages subsisting at the end of the 13th year (or at the beginning of the 14th), and our table shows that the probability of such a marriage becoming fruitful is ·029, so that the probable addition to the number of fruitful marriages arising from these 3, is ·087. Proceeding in this way for the other 9 marriages, we get as the total addition to be made to the fruitful marriages ·341. If we distribute this over the last four years, in the proportion of ·1 to each of the 14th, 15th, and 16th years, and ·04 to the 17th, we shall get the corrected numbers of marriages which became fruitful in each year, as shown in column (7). Making the necessary corrections (the nature of which is obvious) on columns (4) and (5), we get the corrected figures shown in columns (8) and (9), and then division gives us the corrected probabilities shown in column (10). These are repeated in column (2) of the following Table (J); and

Table J.—*Peerage Families.—Table showing the unadjusted Probabilities that a Marriage which has been Childless for a certain number of Years will afterwards become Fruitful.*

Year after Marriage	Husband's Age at Marriage					Wife's Age at Marriage				
	16–29	30–39	40–49	50–59	60 and upwards	15–20	21–25	26–30	31–40	41 and upwards
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	·842	·794	·669	·508	·163	·899	·839	·809	·571	·083
2	·758	·703	·535	·452	·103	·848	·737	·680	·391	·083
3	·515	·434	·315	·250	·028	·619	·474	·466	·222	...
4	·331	·281	·180	·069	·030	·407	·341	·250	·125	...
5	·266	·180	·150	·036	...	·304	·293	·177	·067	...
6	·204	·158	·100	·038	...	·250	·243	·177	·067	...
7	·180	·112	·087	...	...	·167	·222	·125	...	...
8	·152	·072	·087	...	...	·118	·200	·067	...	...
9	·129	·062	·067	...	...	·118	·176	·071	...	...
10	·121	·053	·047	...	...	·118	·152	·071	...	...
11	·099	·040	·026	...	...	·118	·125	·071	...	...
12	·059	·029	·027	...	...	·125	·097	·071	...	...
13	·051	·030	·028	...	...	·133	·100	·077	...	...
14	·033	·016	·029	...	...	·071	·038	·077	...	...
15	·033	...	·029	...	...	·077	·043	...	...	...
16	·032	...	·029	...	...	·083	·045	...	...	...
17	·012	...	...	...	...	·083	...	...	...	...

proceeding in a similar way for the other ages, we obtain the figures shown in columns (3), (4), (5), and (6).

Applying a similar method of calculation to the figures relating to the 498 wives whose ages were known, we get the probabilities shown in columns (7), (8), (9), (10), and (11), of the same table. As the numbers at individual ages are very small, I have not thought it necessary to give particulars as to the wives corresponding to those given as to the husbands in Table (B).

The ratios given in Table (J) proceed with quite as much regularity as could be expected, having regard to the smallness of the numbers under observation; but they are not sufficiently regular to be used in any exact calculations, even if they were otherwise entirely suitable. Table (K) contains, in columns (2), (3), (4), the adjusted probabilities obtained by the graphic method, for husbands of 16–29, 30–39, 40–49, respectively; and in column (5) I have placed, for the purpose of comparison, the adjusted figures which I obtained in 1879 on the assumption that the ages at marriage were—Husband 28, Wife 22. It will be

TABLE K.—*Peerage Families.—Table showing the adjusted Probabilities, for Husbands under* 50 *and Wives under* 26, *corresponding to the unadjusted Probabilities of Table (J).*

Year after Marriage	Husband's Age at Marriage			Results got in 1879 H. 28 : W. 22	Wife's Age at Marriage 15–25
	16–29	30–39	40–49		
(1)	(2)	(3)	(4)	(5)	(6)
1	...	...	...	...	...
2	...	...	...	...	...
3	...	...	...	·180	...
4	·310	...	·180	·110	...
5	·254	·190	·139	·063	·297
6	·213	·148	·108	·046	·252
7	·181	·114	·086	·032	·216
8	·153	·087	·072	·022	·187
9	·128	·070	·058	·015	·163
10	·106	·056	·048	·0115	·142
11	·085	·044	·038	·0086	·123
12	·065	·036	·030	·0063	·105
13	·049	·029	·024	·0046	·088
14	·039	·023	·018	·0036	·072
15	·033	·017	·014	·0028	·057
16	·026	·013	·009	·0021	·043
17	·020	·010	·007	·0015	·030
18	·014	·006	·004	·0010	·018
19	·008	·003	·002	·0006	·007
20	·000	·000	·000	·0003	·000

seen that the probabilities now obtained are several times greater than those I gave formerly. This difference, as already intimated, arises partly from the proportion of childless marriages being less than, in the absence of exact information, I formerly assumed; but it is caused to a very much greater extent by the difference in the character of the statistics pointed out in an earlier part of this paper, namely, that the number of cases in which the birth of the first child was deferred to a late period after marriage, is very much larger among the facts I have collected, than among the other bodies of facts.

Although the new probabilities are much larger than those I formerly obtained, I believe that in many, perhaps in most, of the cases that come before the actuary in practice, and in which it is necessary for him to form some estimate of the probability of the birth of future issue, the actual probability will be greater than that shown in Table (K). In such cases we are, of course, furnished with the ages of both husband and wife. Suppose, for instance, that the husband's age is 35, he having been married 10 years, and that his wife is 30. Table (K) gives ·085 as the probability that issue of the marriage will be born in the 11th year after marriage or subsequently. It is to be observed, however, that the statistics from which this result is deduced, include a certain number of cases in which the wife was older than the husband, and probably some cases in which she was so much older that, when 10 years have elapsed after marriage, she may be considered past childbearing age. If therefore we know, as in the case supposed above, that the wife is still within the childbearing period, it is clear that the probability of the birth of future issue must be greater than that given in the first part of Table (K). This conclusion is supported by a comparison of the probabilities obtained for husbands and wives respectively. The numbers of the wives, when groupt quinquennially, as in Table (J), are too small to give satisfactory results. I have therefore groupt together all the wives who were under 26 at marriage, and I have given in column (6) of Table (K) the adjusted probabilities for these wives. Consistently with what has been said above, the probability of one of these wives who has been married 10 years without issue, subsequently having issue, is considerably larger than the probability shown above: namely, ·123 against ·085.

There seems reason to think that the real probability in

the case of a healthy woman is still greater. For the observations upon which these figures are based will include women in all stages of health, some of them having fallen into permanently bad health. The probabilities in the case of the latter are, of course, less than the average; and it follows that the probabilities in the case of women in good health, must be greater than the average. It sometimes happens in practice that we are able to ascertain other facts, besides the age and health of the wife, which have a material bearing on the probability. For instance, if a wife has had several miscarriages, it may be considered that she is more likely to have a living child than a wife who has never been pregnant. It is sometimes possible for an experienced physician to assign a reason of greater or less probability why a marriage has not been fruitful, and even to give advice or prescribe treatment that may result in the birth of issue; but it would obviously be unsuitable to enlarge upon this subject here. I will therefore only say that Dr. Matthews Duncan, in his Lectures on *Sterility in Woman*, p. 114, states that there is no doubt that sterility is often cured, and gives instances within his own experience. One point, therefore, upon which enquiry should be made when practicable, is whether the wife has ever been under treatment for the cure of sterility.

But when a marriage is unfruitful, we must not assume that it is the wife who is necessarily at fault. Dr. Duncan quotes from Gross *On Male Sterility*, a statement that examination of both husband and wife in 192 cases, demonstrated that the former was at fault in 33 cases, or 17 per-cent of the whole. If we assume that this percentage holds generally, and apply it to the marriages of men under 30, for whom 128 out of 806 were childless, or 159 out of 1,000; it will follow that in 27 of the 159 cases it was the husband who was at fault, or about 3 per-cent of the total husbands were sterile. For the purpose of indicating another point on which enquiry may be made when the circumstances admit, I may mention that I have heard of sterility in the husband arising from severe stricture, and being cured when the cause was removed. There seems also reason to believe that there is occasionally a relative sterility between husband and wife, so that each might be fruitful with another partner.

Discussion.

The Chairman (Mr. M. N. Adler) said he hoped that the paper would elicit a lively discussion.

Mr. A. Day remarked that Mr. Sprague had chosen a subject which had been before them on a great many occasions previously. At one time he (Mr. Day) was somewhat interested in this subject, his particular concern at the time being insurances against issue, in which one of the principal factors was the probability of second marriages and their fruitfulness. Mr. Sprague on the present occasion said nothing about second marriages; no doubt they were included in the 1,522 marriages which formed the basis of his calculations. He observed that out of those 1,522 marriages there were only about 250 which were contracted by a husband at an age greater than 40 years, and 100 at an age greater than 50. Conclusions based only upon 100 marriages were hardly sufficient for precise calculation. The general conclusion derived from Mr. Sprague's paper was that about 80 per-cent of all marriages that were contracted were fruitful, and that about 20 per-cent were unfruitful. Mr. Sprague brought out the probability of unfruitful marriages at 16 per-cent in the most favourable cases, and 21 per-cent in the least favourable. In considering a matter of this kind they had to examine closely the data upon which the conclusions were founded. With regard to Mr. Sprague's data, there could be no doubt about the great care which he had exercised in selecting the observations. With regard to Mr. Ansell's Tables, which had been referred to, there was an inherent defect in the manner in which those statistics were obtained. Schedules were sent out to professional men and others, inviting them to supply returns of the statistics of their families. No doubt, the man who had a very large family, gave information with scrupulous accuracy. On the other hand, if there were no children, the husband would more probably say nothing at all about it, and would not return the schedule. It was difficult to account for the great discrepancy between Dr. Duncan's figures and those of Mr. Ansell and Mr. Sprague. He should be sorry, however, to adopt the explanation Mr. Sprague gave; for that would imply an amount of ignorance of statistics on the part of Dr. Duncan, which could hardly be consistent with his great reputation. Mr. Sprague appeared to attach much importance to the number of births in the first year. He had spent more time on that than on any other point, and it was here there was shown the greatest discrepancy between himself and Dr. Duncan, and between himself and Mr. Ansell. Yet, if they amalgamated the first and second years, they got practically the same percentage in all three, namely, about 80 per-cent of fruitful marriages before the end of the second year. He did not know what Mr. Sprague's object was in this calculation, for it appeared more important, in cases of disentailing, to consider whether the first children born were boys or girls; but he did not say a word about that. [Mr. Sprague—That will come another day.]

Mr. T. Y. Strachan said he had a few statistics which he should be happy to submit to the meeting. Though the numbers were few he hoped they would not be uninteresting. As everything in statis-

tical calculations depended upon accuracy, he could assure the meeting that those to which he was about to refer were very carefully gathered, and might be entirely relied upon. They were drawn from the experience of a Widows' Fund. He was able to test 254 marriages, in 232 of which the marriage experience was exhausted; they had either been dissolved by death, or the wife had passed the child-bearing age. Of those marriages 88 per-cent became fruitful, a material increase upon Mr. Sprague's figures. [Mr. SPRAGUE—Do you exclude women past the child-bearing age?] He included them, and also those who, not having children yet, might have them in the future. [Mr. SPRAGUE—Do you include women of 50?] Yes. The law he adopted for exclusion was that laid down by Mr. Ansell. It varied according to the age of the wife and the number of years which had elapsed since the last child. Applying his figures to Table C of the paper, and reducing them to the denominator of a thousand, he obtained the following result:—444 births in the first year of marriage; 366 in the second; 112 in the third; but he found no births after the ninth. Taking the two first years together, his figures, Mr. Sprague's figures and Dr. Duncan's figures were almost identical. Dr. Duncan made 805, Mr. Sprague made 808, and he made 810. It therefore appeared that that was a very fair exponent of the law, for if they turned to Table B, where the facts were divided according to the ages of the husbands, those under 30 gave very much the same results. That led him to the opinion that the husband's age was not of much importance in the consideration of the subject. Dr. Duncan's method of arriving at his figures produced a marked disagreement in the first and second years respectively, as compared with Mr. Sprague's and his own, but an agreement if the two years were taken together; and with respect to this circumstance, the social conditions of the classes from which the observations were drawn might account for the discrepancy. They must remember that, in considering the births in the first year after marriage, they all occurred in the last three-tenths of the year; and, looking to the births which occurred at the beginning of the second year, he found that 44 per-cent of those which were recorded as in the second year, occurred in the first three months of that year. So there was a great grouping at the end of the first year and the beginning of the second. A difference in the habits of the people might make a material difference in the comparative figures of the first and second years. With a view to giving a little confidence in the smaller figures he had quoted, he had applied to them the test which Mr. Sprague had deduced as the meaning of the paragraph from Mr. Sadler's "Law of Population." The results were as follows:—37·3 per-cent of the marriages were fruitful in the first year—that is to say, of the marriages that subsisted a year, 37·3 per-cent, or very nearly one-half of the 75 per-cent, as Mr. Sprague had explained (*vide* p. 168), were fruitful in the first year. Adding the two first years together, they came to $67\frac{1}{2}$, or very near the two-thirds mentioned. As far as the figures went, he thought some reliance might be placed on the results; but when they had dealt with the first two or three years, they seemed really to have got the whole of the probability. In Table F the percentage of fruitful marriages was 92, which

corresponded with Dr. Duncan's in Table G. Grouping the first two or the first three years, there seemed no difference between the statistics, except as regards Mr. Ansell's. Mr. Ansell gave larger figures in the first two years than any of the others, and he believed Mr. Day's suggestion might account for it. Generally, where there was a large family, the first child was born earlier; if the first child was late, the family was smaller. This might account in some measure for Mr. Ansell's figures. Comparing his own figures with those of Mr. Sprague and Dr. Duncan, he found a remarkable resemblance in those expressing the proportions of births in the earlier years. But he showed a larger proportion of fruitful marriages than appeared in Mr. Sprague's paper.

Mr. A. H. Bailey, while expressing the obligation of the meeting to Mr. Sprague for the labour bestowed on his subject, and for his contribution of actual facts on a matter which was of considerable interest, remarked that, in using the results of Mr. Sprague's investigation for any financial purposes, extreme caution must prevail. He meant for any such purposes as calculating premiums of insurance against issue, determining the interest of an heir of entail, or valuing contingent reversions. He was very doubtful as to whether fruitfulness of marriage was subject to law. He thought it rather depended on individual circumstances. They were all satisfied that of 1,000 men, women, and children taken at random, 22 would be dead in twelve months' time. They knew also that the proportion of letters put into the letter-boxes without address, varied very little from year to year. They knew further that with regard to classes—Mr. Day had provided statistics—there was a law of marriage. But when they came to the question of fruitfulness of marriage, it depended surely not on statistics but on physiology. He feared they would get into some serious mistakes if they attempted to make use of results such as these. He could not see why so much pains had been spent on arriving at the rates for the first and second years. Formerly Lodge's Peerage recorded still-born births, but in the later editions still-born births were omitted. Therefore, they could not for this purpose depend upon Lodge's Peerage, inasmuch as both still-born births and miscarriages must be taken into account when dealing with this subject. He failed to see any particular object or any particular interest attaching to the fact of whether a child was born in the first or second year; and he agreed with Mr. Strachan that the age of the husband had little or nothing to do with the questions. While he thought these statistics could only be used for any definite purpose to a very small extent, he admitted that it would be exceedingly valuable if they could determine the number of years after which it might be safe to assume that there would be no issue of a marriage. There were two cases in his own mind of children being born long after marriage, in one of which eleven years had elapsed. While it might be safely assumed that, if twenty years elapsed, there would be no issue; what the limit was below that, seemed a matter of some speculation.

Mr. A. J. Finlaison asked Mr. Sprague if he would explain how he deduced the numbers in Table I from which he calculated the probability of a hitherto unfruitful marriage subsequently became

fruitful? In Table B, in the fourteenth year, there were five marriages still existing. He could not clearly see what became of them.

Mr. G. S. Crisford thought it eminently satisfactory that, taking the statistics of all the authorities, there was a great similarity in the results in the earlier years of marriage. For instance, it appeared from the statistics of Mr. Strachan, Mr. Ansell, Dr. Duncan, and Mr. Sprague, that, if they took the first three years of marriage, between 91 and 92 per-cent were fruitful. If the next two were taken, they would see that 96 per-cent became fruitful within the five years. It had occurred to him that, this being so—although the probability brought out in the tables of a marriage becoming fruitful after a certain lapse of years, continually decreased year by year (4 per-cent being the average after five years)—it would be a dangerous thing to deal with the actual numbers for any definite calculations. They might take the probability of a marriage becoming fruitful during the first five years, as about 96 per-cent; and the circumstances guiding the probability of issue after that, were not dependent upon any law so much as upon the individual circumstances of individual cases. On the subject of unfruitful marriages, he should like to ask Mr. Sprague if any figures had come before him to explain the grouping of ages. In the case of men (Table A), they found in the first grouping the percentage of unfruitful marriages was 16 per-cent, and then it increased to 21 per-cent; from age 40 to 49, it was 33 per-cent; from 50 to 59, 49 per-cent, and after that it was 84 per-cent. Therefore, although the average of unfruitful marriages might be 22 per-cent, it might not be improbable that, in the marriages which took place in later years, men married wives who were past the child-bearing age. From Table E the percentages of unfruitful marriages for wives was 18, although it was much more for men. He should like to know whether there were any statistics to show that an unfruitful marriage, might be just as much caused by the husband as by the wife. In the last paper it was suggested that one woman out of every ten was barren, and that as regards men it was one out of every 200. These figures would seem to point to quite a different conclusion. Perhaps Mr. Sprague could give some information upon it. He joined in considering the paper valuable in itself and for the statistics it contained.

Mr. A. F. Burridge remarked that the facts upon which Mr. Sprague's paper was based, would bear exceedingly well upon the class of people with which issue risk was usually connected; for it was persons with a peerage, and of a similar class, who had need to go to insurance offices for quotations for issue premiums. Alluding to the difference which appeared between Mr. Sprague's and Dr. Duncan's statistics, he would throw out a conjecture as to the reason for the deferment in the birth of the first child, which was much later in Mr. Sprague's table than in Mr. Duncan's. Might it not be in the class of people to which Mr. Sprague's statistics referred, that marriages took place on the average at a somewhat earlier age than usual. It would probably be found that in peerage families, ladies were married at an earlier period than among the general population. In the cases mentioned in the paper, where the ages of females at

marriage were known, the greatest number took place at ages 20–22. This view was suggested by Mr. Sprague's Table F, where it appeared that the probability of a marriage becoming fruitful within the first year, increased with the age of the wife up to age 28. Then, was not there something approaching to a law with regard to the infertility of heiresses? He understood that heiresses were certainly less fertile than other women. Mr. Francis Galton, the well-known writer on social subjects, had given some statistics on this subject. Taking 100 marriages of heiresses, and 100 of those who were not heiresses, he found that the 100 heiresses bore 208 sons, whereas the other 100 bore 336.

Mr. G. H. Ryan said that, whether Mr. Sprague's paper was regarded in the light of a contribution to physiological science, or of an addition to the actuary's tool-chest, it was one of paramount interest and importance. The facts were slender in volume, and seeing that they were all taken from one class of the community, they might be open to the objection that they were not capable of general application; but the data now submitted to the Institute, showed a marked improvement in magnitude and trustworthiness over those submitted on a previous occasion. It was, therefore, only reasonable to expect that future statistics brought forward by Mr. Sprague (or other authors) would present in a still more marked degree these features of excellence and improvement. In connection with the comparison which Mr. Sprague had instituted between Mr. Ansell's results and his own, it might be useful to point out that Mr. Ansell's figures related to marriages of spinsters, whereas Mr. Sprague's referred to spinsters and widows. That might lead to some disturbing element, although it was probable that the disturbance would not be great. Mr. Sprague referred to the increasing fertility of marriages, and on that subject it might be interesting, as a matter of history, to state that Captain John Graunt, whose name was well known as a writer on insurance matters 220 years ago, stated that marriages at that time, one with another, produced four children. Mr. Ansell, in his more recent statistics, brought out the result as 4·8, so that if Graunt's figures were trustworthy, they seemed to show that there had not been much increase in the productiveness of marriages during so long a period as 220 years. He thought that the necessity for issue statistics was becoming increasingly apparent. In connection with disentail cases in Scotland they were, no doubt, of great practical value. Also in connection with the valuation of Widows' Funds, cases would arise in which such information would be of material assistance. Another instance of their usefulness would be in connection with the confinement benefits granted by certain friendly societies. For such a purpose Mr. Ansell's figures would be more applicable than Mr. Sprague's, seeing that Mr. Ansell gave the number of children to each marriage, on which point Mr. Sprague in his present paper said nothing. No doubt, in dealing practically with cases in which large sums of money were involved, the greatest care and caution would have to be exercised in taking into account the exact circumstances and conditions.

Mr. W. J. H. Whittall observed that Mr. Sprague, in his quotations from Mr. Sadler's *Law of Population*, came to the

conclusion that in the first quotation he was referring to fruitful wives, and in the second to total marriages. He, however, thought in each case Mr. Sadler referred to fruitful marriages. His words were, "before the termination of the year following." Was he then speaking of the calendar year following the year in which the marriage took place? That on the average would give a period of 18 months from the time of marriage. If they referred to columns 1 and 2 of Mr. Sprague's Table F, they would find the figures closely agree with Mr. Sadler's.

The Chairman (Mr. M. N. Adler), in moving a vote of thanks to the author, referred to the figures put forward by Dr. Duncan. He would point out that Dr. Duncan's observations were based on certain returns of the Registrar-General of Scotland for 1855. It was the first year that systematic registration was introduced into Scotland; but it was found that the elaborate returns required that year were too inquisitorial, and those for the following year were very much simplified, so that the valuable material which enabled Dr. Duncan to make his investigations, is no longer forthcoming. The same is now the case for England and Scotland, although on the Continent they do not appear to mind what inquisitorial questions are put. The returns for Belgium and France, and for Prussia, are very full, and deal with a number of those questions which have been mentioned. Dr. Duncan's observations referred to the general population of Glasgow and Edinburgh; and the great bulk of that population is the working classes, whose mode of living is very different from that of the nobility. That, of course, tells very much on this question of childbearing. He believed that would account for some of the difference between Mr. Sprague's and Dr. Duncan's Tables. They must all regret that Mr. Sprague had been able to give the ages of the wives in the case of only a third of his statistics. He could not understand why Mr. Sprague should assert that Dr. Duncan had not given any means of studying how many childless marriages took place at different ages. If Mr. Sprague referred to the ages of husbands, it might be true; but as regards the ages of wives (which after all was the more important element) that was fully given in the Table on page 200 of Dr. Duncan's book. Referring to the data contained in Lodge's Peerage, he would ask Mr. Sprague whether he was at all satisfied within what period the birth of children was recorded. He should think that, if a child died within the first one or two months, it would not find its way at all into Lodge's Peerage. The returns to the Registrars, on which Dr. Duncan constructed his Table, had to be made within six weeks after the child's birth. An interesting paper by Mr. George Darwin, son of the eminent Charles Darwin, appeared in the *Fortnightly Review* for 1875, and in the *Statistical Journal*, as to the fertility and other results of marriages between cousins. Mr. Darwin sent out many hundreds of forms, and also made an investigation into the returns of the peerage. He used Burke's Peerage; and in so doing he was troubled by the fact that Burke omitted, not only all cases of still births, but even many of the children born in the first year if they died. Daughters were often omitted altogether. It might be interesting to mention some of Mr. Darwin's results. He showed the

percentage of sterile marriages, first of all among non-consanguineous couples, as based upon Burke's Peerage, to be 15·9 for every 100 marriages, which rate was very near to the figures before quoted. The percentage amongst parents who were first cousins ranged from 14·7 to 20·9. Then, in the case where one parent was the offspring of first cousins, the percentage was 17·2. It might also be interesting to state that Mr. Darwin found that marriages between first cousins were as much as 4 per-cent of all the marriages among the nobility, and 1½ for the whole population of London. In the country and small towns it was between 2 and 3 per-cent. He was glad Mr. Sprague had a paper forthcoming as to fertility of marriages in which the sexes of the children would be distinguished, as that might bring out, among other results, the fact that Mr. Samuel Brown had referred to, that sex much depended upon the difference between the ages of the parents. Where, he urged, the difference between the age of the father and mother was great, the sex was likely to be male.

Mr. Sprague, in reply, said that he had excluded from his observations certain marriages, as Mr. Day had remarked. For instance, he had excluded the marriages of all the fathers of the peers, or rather those marriages of which the peers were born. In going through the peerage in order to get particulars of a number of marriages for his first paper, he took all the men who married over the age of 40; but subsequent reflection satisfied him that, by including the fathers of peers, he got an undue proportion of men who had children, and that, therefore, it would be more correct to exclude them. His observations, however, included several second marriages—in fact, all second marriages except those of which any peer was born. Mr. Day suggested that 100 marriages was not a sufficiently large number to draw any conclusion from. It was, no doubt, a small number, but the 151 marriages between the ages of 40 and 50, and the 108 above the age of 50, should be considered along with the much greater numbers at younger ages; and when this is done, it will be found that the same law holds in proceeding from the more numerous marriages at the younger ages to the less numerous at the older ages, and thus the latter are entitled to greater confidence than if the figures stood alone. Then Mr. Day had mentioned an objection to Mr. Ansell's statistics, that some people to whom schedules were sent, would throw them on one side and not fill them up. These remarks would probably apply to the case of large families in which there had been a great number of deaths, as it would be painful to the father to record the deaths of his young children. Mr. Day had also asked him why he took so much pains to investigate the question why the proportion of children born in the first and second years after marriage, differs in the different observations. In itself the matter is not of much importance, but anything that bears upon the accuracy of statistics becomes important. If it were found that in one respect the statistics were evidently drawn up on a wrong principle, confidence would be shaken in the whole. The statistics Mr. Strachan had furnished were very useful as corroborating the results of the paper. But he hesitated to accept, until further enquiry, Mr. Strachan's statement that 88 per-cent of the total marriages were fertile. To exclude from consideration all marriages which

might still possibly become fruitful, is going too far. It would be better to make a calculation of how many of them would probably become fruitful; and if the figures were treated in that manner, he thought the results would be more like those in the paper. [Mr. STRACHAN—Taking all the marriages it would be 81 per-cent. That was the other extreme again.] There was no doubt that the husband's age was not of much consequence, although he would not go so far as to say it was of no consequence. It certainly became of consequence at advanced ages; for when a man was very old, there was little probability of his having children. He had not in his statistics a single case of a man over 80 having a child, and the loss of virile power must be gradual. For a young or middle-aged man the age is, however, of very little consequence: and the age of the wife is more important. No doubt the principal reason why the percentage of unfruitful marriages increases with the age of the husband (Table A), is because the age of the wife is greater. Mr. Bailey had expressed the opinion that fertility of marriage is not subject to law in the same way as mortality. Upon that point he joined issue. The whole of nature, including therein human nature and civilization, follows laws; and whenever a sufficiently large average is taken, the law will be manifest. The question of still-births was one to which he had not given special attention, and he could not say whether such were usually recorded in Lodge's Peerage. There are, however, a great many cases in Lodge's Peerage of children being entered who died quite young; and he imagined that the returns are in this respect tolerably correct. As to the appropriateness of these statistics for business purposes, he thought that, at all events for disentail calculations, they would be suitable, because the Judges have laid down that, when probability of issue was to be estimated, no personal enquiry should be made as to the individual circumstances. The figures would also be useful in calculating the probabilities of issue by a future marriage. In reply to Mr. Crisford and others, he would say that the facts must be considered as a whole. There are a considerable number of facts during the years that immediately follow marriage, and these give an indication of a law; and joining these on to the facts of subsequent years, a sufficiently trustworthy law is obtained by use of the graphic method, which yields graduated results agreeing with the rough facts and entitled to considerable confidence. As to heiresses being unfruitful, on one occasion he had to examine Mr. Galton's statistics very carefully. A valuation was made by him for the Court of Justice in Scotland, and was objected to, on the ground that he had allowed too great a probability of issue to a young lady, who was an heiress and might therefore be expected to be less fruitful than the average. He had to consider this point and report to the judge his opinion upon it; and he came to the conclusion that, whatever truth there might be in Mr. Galton's statements, his facts did not bear out his conclusions. With regard to the quotation from Graunt's book that, in his time, there were 4 children to a marriage, he did not think the statement sufficiently precise to justify any conclusions being based upon it. Were unfruitful marriages included in his estimate or not? He was much interested to hear of the paper by George Darwin, as it had a very important bearing on

the question. His figures as to the frequency of marriage amongst cousins in the Peerage, were very interesting. The whole question of the fertility of marriage between near relations is an important one physiologically. The Chairman had pointed out that only $1\frac{1}{4}$ per-cent of the marriages in the general population were amongst first cousins. But what available means had Mr. Darwin of ascertaining that only $1\frac{1}{4}$ per-cent of the marriages in the general population were amongst first cousins? With regard to the other question, as to whether the sex of children depends upon the ages of their parents, Mr. S. Brown had mentioned it some years ago (*J.I.A.* iii, 17), but he gave no facts of his own, and merely quoted from Sadler's book. Mr. Sadler had given an interesting table, which certainly seemed to prove that the sexes of the children depend upon the difference between the ages of the parents; and that if the husband is much older, there were likely to be more sons than if the husband were the same age as the wife, and if he were younger there would probably be more daughters. He (Mr. Sprague) had investigated that question by statistics which did not support Mr. Sadler's conclusions—in fact, he did not think that the age of the parents had any influence on the matter. But he hoped to investigate that question further.

Office Premium Loadings, and how they are dealt with under the various methods of Valuation and modes of Distribution of Profits. By George S. Crisford, *Fellow of the Institute of Actuaries, and Actuary to the Rock Life Assurance Company.*

[Read before the Institute, 30 March 1885.]

In introducing a consideration of this subject to the Institute, I do not purpose putting forward any new theories; many papers have been written upon the different methods of valuation and the modes of distributing profits, which have been most valuable contributions for determining the best theoretical basis to be adopted. I need only refer to the papers of Messrs. Jellicoe, Sprague, Bailey, Meikle, Manly, Valentine, King, and others, all of which are to be found in the Journal of the Institute, in order to remind you how fully these subjects have been considered at different times. The present paper, however, is intended to investigate the practical effect of applying the respective theories, not upon any theoretical assumption, but as they have to be applied in actual practice, and to see how far they are influenced by the different rates of premium actually charged by the different companies.

We have two opposite schools of opinion upon the subject of the proper mode of valuation of policies.

1. Those who advocate the pure premium method.
2. Those who prefer the gross premium method.

One will tell us the only safe way of dealing with the business of a company in order to estimate its liabilities, is to make a pure premium valuation, and to reserve the whole of the loading, thus guarding against the anticipation of any future profits.

The other will say the true practical view of the business of a company is to estimate the value of the liability of the sums assured on the one hand, and to set against that the value of the actual premiums payable upon the other, making such a reserve for future expenses and profit as circumstances may make it advisable.

Now there may be strong arguments on both sides, but I think it will be generally admitted that however sound in theory the advocates of the pure premium method may be, it is most important, if not absolutely essential to sound management, that in practice, the actual premium payable, should be taken into consideration.

This becomes more apparent when the loading upon the premiums is examined for different ages at entry.

I must again remind you that the present paper is not intended as a criticism upon any of the present rates of premium charged, or upon the methods adopted in valuations, or in distribution of profits, but I desire to bring out, as prominently as I can, how much the results of the application of theoretical principles may be influenced by the practical details embodied in working them out.

I desire also to bring forcibly to the minds of the younger members of the Institute, the great value of the practical application of the theoretical knowledge which they gain by the study of life assurance principles. It is not at all uncommon to read articles or letters in the public press in which the boldest assertions are made, based merely upon a theoretical knowledge, and which if applied to practical facts would show results altogether at variance with the assertions. The more experience a man gains, the less ready is he to pronounce any decided opinion upon mere superficial appearances, and if I succeed in forcing this conclusion upon the

minds of any of our future actuaries, I shall feel my paper will not be without its value.

I will now proceed to an examination of the premiums charged by different offices for effecting whole-life with-profit policies.

It is self-evident that companies cannot, at will, alter their tables of rates; they are bound by existing practice, custom, and competition, and no matter what new theories may arise, or what new table of mortality may be adopted, the rates charged to the public, to a great extent, will remain the same. Now I think I am right in saying, that all the papers which have been written hitherto upon the subject of valuation have been based upon certain theories, which have been distinct from the question of the rates actually charged, although they have assumed the employment of certain tables of mortality, and that according to such tables the premiums have been loaded: how much or how little that loading has been was not considered.

I will endeavour to divide my paper under the following heads:

I.—The premiums actually charged by the leading life assurance companies at ages 20, 25, 30, 35, 40, 45, 50, 55, and 60.

Showing the actual loading according to different tables of mortality and rates of interest.

A division of this loading into reserve for expenses and margin for profits.

An examination of the results as modified by the different loadings under various methods of valuation.

II.—The effect of different modes of distributing the profits under the different scales of loading and methods of valuation.

I have formed tables to show the loadings upon the premiums as charged by different companies, all whole-life with-profit rates, according to the following pure premium tables:

H^M . . .	3 per-cent, $3\frac{1}{2}$ per-cent, and 4 per-cent.
Carlisle . .	3 per-cent, $3\frac{1}{2}$ per-cent, and 4 per-cent.
Northampton	3 per-cent.
17 Offices	3 per-cent.
No. 3 English Life Table	3 per-cent.

An examination of these tables, and the results under various methods of valuation, will occupy the first part of my paper, and I purpose dealing with the second part on a future occasion.

The tables are very extensive, and are not included in this paper, as they contain many pages of figures which would not be of permanent value, and which have only been compiled for the purpose of a general examination of the loadings. An investigation of the loading of any particular office at any time would be a matter of great simplicity and little labour.

I found it necessary to take a large number of offices, because the rates vary considerably, and also because I wished to group together various companies adopting the same basis of valuation, and then to compare the respective loadings under each group according to the premiums charged.

In the second part of the paper, I shall also group the offices according to the methods of distribution. It will thus be seen that in order to make a thorough investigation, it would be quite useless picking out some half a dozen companies: I have therefore taken 56 companies. First, I tabulated their actual with-profit rates, then made a deduction of the pure premium under the various tables, leaving the full actual loading. The next question to determine was how to arrive at the proportion of loading which should be set aside for expenses. It is impossible to adopt any estimate which will apply to every company; there are a few companies who spend more than a reasonable amount of the loading in expenses, and some few others who pay no commission, and whose expenses, from various causes, may be less than a reasonable estimate. I believe, however, that the general body of companies spend very much the same proportionate amount annually. The question then arises, How shall that amount be estimated as forming part of the loading of a premium?

A very general plan is to take a fixed percentage of the premiums, and if the premiums are to be the measure of expense it would be the only one, for although the expenses may for the sake of comparison be divided into new business expenses and renewal expenses, a heavier charge upon the new premiums virtually resolves itself into a percentage upon the premiums spread over future years or taken out of future loadings. To illustrate this, I have taken $12\frac{1}{2}$ per-cent of the gross premiums as being a reasonable charge for expenses, and have shown, under that estimate, how the loading is apportioned between expenses and margin for profit,

net premium H^M 3 per-cent. I have also formed a table dividing H^M 4 per-cent loadings in the same way.

In addition to this I have also estimated the expenses in the following way, which I think the more correct:

> 5 per-cent on the gross premium to pay commission.
>
> And for general expenses a constant of 5*s.* per-cent per annum on the sum assured to pay other expenses.

This estimate has the effect of placing a heavier charge against the young lives when measured against the premium, but an equal amount when measured by the sum assured, and I think it is obvious that it cannot cost more to manage the business for a £100 policy whether the life is 20, 40, or 60, after the payment of commission is provided for. For practical purposes, I think a constant upon the sum assured is fair, and is a better measure of general expenses than a percentage upon the premiums paid.

In order that a general view of the loadings and expenses may be taken, I have given two tables, which I think will amply exemplify the whole of the tables which I have above referred to, namely, Tables showing the Margin of Loading, H^M 3 per-cent and H^M 4 per-cent: that is, the loadings contained in the gross premiums charged by 56 offices after deducting therefrom 5 per-cent on gross premium for commission, and a constant of 5*s.* per-cent on the sum assured for general expenses. It should be borne in mind that whenever the expenses exceed this, the margin of loading will be proportionately diminished.

TABLE A.—*Showing Margin of Loading, or how much of the gross Premium, as charged by* 56 *Companies respectively, is left after deducting pure Premium* H^M 3 *per-cent, and allowing for Expenses* (5 *per-cent on gross Premium for Commission and* 5*s. per annum per* £100).

No. of Office	20	25	30	35	40	45	50	55	60
1	−·288	−·355	−·392	−·440	−·484	−·578	−·689	−·874	−1·147
2	−·157	−·118	−·134	−·211	−·227	−·182	−·155	−·130	−·062
3	−·034	−·023	−·028	−·024	·000	·045	·106	−·004	−·185
4	−·015	·033	·072	·074	·114	·072	·099	·266	·484
5	·017	−·070	−·158	−·228	−·238	−·240	−·175	−·134	−·224
6	·025	·065	·096	·102	·122	·076	·075	·206	·362
7	·037	·029	·072	·094	·137	·250	·328	·599	·963
8	·064	·109	·147	·158	·190	·151	·166	·317	·508
9	·077	·144	·207	·248	·320	·325	·423	·721	1·122
10	·077	·144	·207	·248	·320	·325	·423	·721	1·122
11	·080	·167	·175	·169	·177	·198	·249	·226	...
12	·092	·144	·187	·206	·248	·222	·261	·429	·639
13	·097	·148	·187	·213	·245	·218	·249	·420	·639
14	·097	·148	·191	·209	·248	·218	·249	·424	·634
15	·104	·136	·162	·186	·209	·226	·276	·420	·603
16	·104	·084	·045	−·013	−·080	−·182	−·286	−·384	−·453
17	·108	·164	·215	·253	·288	·341	·423	·424	·342
18	·112	·164	·210	·228	·272	·246	·284	·471	·694
19	·117	·148	·191	.248	·327	·440	·601	·824	1·133
20	·124	·164	·195	·201	·221	·175	·177	·305	·459
21	·128	·179	·246	·264	·248	·098	·225	·300	·413
22	·136	·160	·187	·217	·256	·313	·391	·487	·614
23	·136	·187	·238	·264	·300	·274	·326	·305	·271
24	·144	·160	·182	·209	·241	·282	·336	·400	·484
25	·152	·195	·225	·228	·248	·191	·181	·290	·413
26	·159	·179	·191	·166	·153	·064	·011	·052	·088
27	·159	·215	·246	·264	·265	·310	·384	·471	·572
28	·168	·199	·218	·206	·209	·143	·114	·210	·302
29	·168	·187	·210	·233	·260	·290	·320	·345	·449
30	·168	·204	·215	·217	·248	·162	·177	·250	·307
31	·179	·215	·238	·241	·265	·277	·351	·329	·318
32	·183	·223	·277	·348	·441	·539	·664	·796	·926
33	·187	·199	·215	·225	·241	·257	·272	·286	·294
34	·192	·199	·210	·228	·252	·286	·340	·404	·504
35	·192	·226	·254	·284	·307	·310	·276	·186	·025
36	·192	·226	·254	·284	·307	·310	·276	·186	·025
37	·192	·226	·254	·284	·307	·310	·276	·186	·025
38	·192	·223	·235	·225	·205	·175	·141	·274	·472
39	·203	·215	·225	·245	·288	·352	·443	·550	·698
40	·215	·215	·222	·228	·245	·266	·292	·317	·552
41	·223	·226	·230	·228	·212	·242	·245	·226	·251
42	·227	·175	·191	·209	·225	·226	·266	·369	·528
43	·239	·266	·282	·292	·292	·274	·261	·321	·385
44	·263	·263	·257	·248	·245	·238	·233	·199	·132
45	·263	·294	·305	·308	·300	·254	·181	·036	−·188
46	·267	·306	·321	·320	·307	·293	·284	·179	−·034
47	·290	·299	·282	·261	·229	·155	·106	·029	−·188
48	·294	·279	·262	·245	·225	·206	·189	·171	·152
49	·322	·334	·330	·320	·307	·262	·253	·424	·639
50	·322	·274	·257	·257	·268	·274	·261	·242	·195
51	·349	·341	·330	·320	·320	·321	·340	·369	·508
52	·365	·330	·330	·320	·307	·257	·182	·016	−·236
53	·393	·409	·408	·399	·387	·337	·256	·076	−·188
54	·393	·409	·408	·399	·387	·337	·256	·076	−·188
55	·773	·800	·833	·907	1·011	1·124	1·325	1·500	1·513
56	·298	·325	·359	·428	·478	·582	·550	·725	·905

Table B.—*Showing Margin of Loading, or how much of the gross Premium, as charged by* 56 *Companies respectively, is left after deducting pure Premium* H^M 4 *per-cent, and allowing for Expenses* (5 *per-cent on gross Premium for Commission and* 5*s. per annum per* £100).

No. of Office	20	25	30	35	40	45	50	55	60
1	−·105	−·158	−·182	−·216	−·247	−·329	−·431	−·607	−·875
2	·026	·079	·076	·013	·010	·067	·103	·137	·210
3	·149	·174	·182	·200	·237	·294	·364	·263	·087
4	·168	·230	·282	·298	·351	·321	·357	·533	·756
5	·200	·127	·052	−·004	−·001	·009	·083	·133	·048
6	·208	·262	·306	·326	·359	·325	·333	·473	·634
7	·220	·226	·282	·318	·374	·499	·586	·866	1·235
8	·247	·306	·357	·377	·427	·400	·424	·584	·780
9	·260	·341	·417	·472	·557	·574	·681	·988	1·394
10	·260	·341	·417	·472	·557	·574	·681	·988	1·394
11	·263	·364	·385	·393	·414	·447	·507	·493	...
12	·275	·341	·397	·430	·485	·471	·519	·696	·911
13	·280	·345	·397	·437	·482	·467	·507	·687	·911
14	·280	·345	·401	·433	·485	·467	·507	·691	·906
15	·287	·333	·372	·410	·446	·475	·534	·687	·875
16	·287	·281	·255	·241	·157	·067	−·028	−·117	−·181
17	·291	·361	·425	·477	·525	·590	·681	·691	·614
18	·295	·361	·420	·452	·509	·495	·542	·738	·966
19	·300	·345	·401	·472	·564	·689	·859	1·091	1·405
20	·307	·361	·405	·425	·458	·424	·435	·572	·731
21	·311	·376	·456	·488	·485	·447	·483	·567	·685
22	·319	·357	·397	·441	·493	·462	·649	·754	·886
23	·319	·384	·448	·488	·537	·523	·584	·572	·543
24	·327	·357	·392	·433	·478	·531	·594	·667	·756
25	·335	·392	·435	·452	·485	·440	·439	·557	·685
26	·342	·376	·401	·390	·390	·313	·269	·319	·360
27	·342	·412	·456	·488	·502	·559	·642	·738	·844
28	·351	·396	·428	·430	·446	·392	·472	·477	·574
29	·351	·384	·420	·457	·497	·539	·578	·612	·721
30	·351	·391	·425	·441	·485	·411	·435	·517	·579
31	·362	·412	·448	·465	·502	·526	·609	·596	·590
32	·366	·420	·487	·572	·678	·788	·922	1·063	1·198
33	·370	·396	·425	·449	·478	·506	·530	·553	·566
34	·375	·396	·420	·452	·489	·535	·598	·671	·776
35	·375	·423	·464	·508	·544	·559	·534	·453	·297
36	·375	·423	·464	·508	·544	·559	·534	·453	·297
37	·375	·423	·464	·508	·544	·559	·534	·453	·297
38	·375	·420	·445	·449	·442	·424	·399	·541	·744
39	·386	·412	·436	·469	·525	·601	·701	·817	·970
40	·398	·412	·432	·452	·482	·515	·550	·584	·824
41	·406	·423	·440	·452	·449	·491	·503	·493	·523
42	·410	·372	·401	·433	·462	·475	·524	·636	·800
43	·422	·463	·492	·516	·529	·523	·519	·588	·657
44	·446	·460	·467	·472	·482	·487	·491	·466	·404
45	·450	·491	·515	·532	·537	·503	·439	·303	·084
46	·450	·503	·531	·544	·544	·542	·542	·446	·238
47	·473	·496	·492	·487	·466	·404	·364	·296	·084
48	·477	·476	·472	·469	·462	·455	·447	·429	·424
49	·505	·531	·540	·544	·544	·511	·511	·691	·911
50	·505	·471	·467	·481	·505	·523	·519	·509	·467
51	·532	·538	·540	·544	·557	·570	·598	·636	·780
52	·548	·527	·540	·544	·544	·506	·440	·283	·036
53	·576	·606	·618	·623	·624	·586	·514	·343	·084
54	·576	·606	·618	·623	·624	·586	·514	·343	·084
55	·956	·997	1·043	1·131	1·248	1·373	1·583	1·767	1·785
56	·481	·522	·569	·652	·715	·831	·808	·992	1·177

A careful examination of these tables shows that there exists a very striking difference in the margin of loading at different ages at entry, even in the same company, and much more so when the premiums charged by the various companies are examined.

To bring out the difference more forcibly, let us suppose that two companies are to be started, one in which the directors decide to fix at every age the lowest premium charged by any of the existing companies, another the highest premium charged.

Extreme cases always afford the most striking illustrations, and it must be borne in mind that they are actual facts brought to bear in one office or another, and that the results must be the same as regards the individual cases, although, in the valuation by a particular office, the average results may altogether obliterate any extreme case, and make it to be of little or no importance. It does not follow, however, that such extremes should not be noted.

The following tables (pp. 192, 193) give, for ages 20, 25, &c., up to 60, 3 per-cent and 4 per-cent:

1. The lowest actual rates charged for £100 assurance.
2. Loading after deducting H^M net premium.
3. Amount of loading absorbed in expenses—
   (1) at 12½ per-cent of gross premium;
   (2) 5 per-cent for commission, and 5*s*. per £100 for general expenses.
4. Margin of loading for profits.
5. The net premiums, H^M.

Similar particulars for the highest rates charged.

You will observe that in the low premiums the largest loading for profit and expenses is at the youngest age, in the high rates it is at the oldest age, and in the case of the low premium rates the largest loading, after deducting H^M 3 per-cent net premium, is barely sufficient to pay expenses, and even H^M 4 per-cent only leaves a margin for profit for ages at entry under 30.

An examination of all the tables of loadings will show the greatest variations in the rates are found at the younger and older ages, although even at the middle ages in a few instances there are great differences, as already seen; but the great majority of offices charge very similar rates at the middle ages, and the variation of the loading is consequently very little for ages between 30 and 50. There seems to be no law, however, for arranging the loadings from the lowest to the highest—for instance, in H^M 3 per-cent table,

Table C.—H^M 3 per-cent Net Premiums.

Rates of Premiums as charged by different Companies selected at the various Ages.

Age	Lowest Rate	Loading	Expenses		Margin for Profit		H^M 3 °/₀ Net Premiums	Highest Rate	Loading	Expenses		Margin for Profit	
			1.—12½ °/₀	2.—5 °/₀ and 5*s*.	1	2				1.—12½ °/₀	2.—5 °/₀ and 5*s*.	1	2
20	1·729	·302	·216	·336	·086	−·034	1·427	2·179	·752	·272	·359	·480	·393
25	1·900	·275	·238	·345	·037	−·070	1·625	2·404	·779	·300	·370	·479	·409
30	2·075	·196	·260	·354	−·064	−·158	1·879	2·671	·792	·334	·384	·458	·408
35	2·342	·149	·292	·377	−·143	−·228	2·193	2·992	·799	·374	·400	·425	·399
40	2·738	·149	·342	·387	−·193	−·238	2·589	3·442	·853	·430	·412	·423	·441
45	3·288	·174	·411	·414	−·237	−·240	3·114	4·108	·994	·514	·455	·480	·539
50	3·962	·162	·495	·448	−·333	−·286	3·800	4·962	1·162	·620	·498	·542	·664
55	4·833	·108	·604	·492	−·496	−·384	4·725	6·104	1·379	·763	·555	·616	·824
60	6·088	·101	·761	·554	−·660	−·453	5·987	7·758	1 771	·970	·638	·801	1·133

Offices Nos. 1, 2, and 55 have been omitted in the above selection.

Table D.—H^M 4 per-cent Net Premiums.

Rates of Premiums as charged by different Companies selected at the various Ages.

Age	Lowest Rate per £100	Loading	Expenses		Margin for Profit		H^M 4 °/o Net Premiums	Highest Rate	Loading	Expenses		Margin for Profit	
			1.—12½ °/o	2.—5 °/o and 5*s*.	1	2				1.—12½ °/o	2.—5 °/o and 5*s*.	1	2
20	1·729	·484	·216	·336	·268	·148	1·245	2·179	·934	·272	·359	·662	·575
25	1·900	·472	·238	·345	·234	·127	1·428	2·404	·976	·300	·370	·676	·606
30	2·075	·406	·260	·354	·136	·052	1·669	2·671	1·002	·334	·384	·668	·618
35	2·342	·373	·292	·377	·081	−·004	1·969	2·992	1·023	·374	·400	·649	·623
40	2·738	·386	·342	·387	·044	−·001	2·352	3·442	1·090	·430	·412	·660	·678
45	3·288	·423	·411	·414	·012	·009	2·865	4·108	1·243	·514	·455	·729	·788
50	3·962	·420	·495	·448	−·075	−·028	3·542	4·962	1·420	·620	·498	·800	·922
55	4·833	·375	·604	·492	−·229	−·117	4·458	6·104	1·646	·763	·555	·883	1·091
60	6·088	·373	·761	·554	−·388	−·181	5·715	7·758	2·043	·970	·638	1·073	1·405

Offices Nos. 1, 2, and 55 have been omitted in the above selection.

Office standing No. 10 for age 20
would stand No. 54 for age 60;
and Office standing No. 52 for age 20
would stand No. 3 for age 60;

and so on without any regularity.

Looking next at the different Tables of Mortality, it will be seen that up to age 40 the H^M Tables give the smallest net premiums, and consequently show the highest loadings; that from the age of 40 upwards the Carlisle Table gives the highest loadings; that the 17 Offices Experience Table gives premiums a little in excess of the H^M, all through the rates being closest at the older ages. The Northampton Table in the great majority of instances shows a net premium in excess of the premiums usually charged. In two offices the Northampton net premium rates are the rates actually charged, and it will be seen that these rates in themselves contain throughout a sufficient margin in excess of any net premium at present adopted by other companies.

The result of my examination of the different rates has led me to the conclusion that there are very many arguments against low rates of premium at the younger ages, they have the effect of giving most of the profits to the bad lives, and offices charging higher rates are not only much stronger financially, but they reserve a fair margin to accumulate for profit and contingencies, which ultimately more than recoup the good lives for the slightly higher rates of premium which they pay at the time of effecting a policy—while to those who die early a very ample return upon their payments is made in the insurance moneys with any bonus additions which may be declared.

This view becomes stronger when the effect of the different loadings upon a valuation is examined.

For this purpose let us first again suppose two new tables of rates are to be formed by selecting one from the lowest rates charged by different companies and the other from the highest.

Tables E, F, G, H (pp. 195–198), will exemplify these rates for ages 20, 25, 30, &c.; and now, assuming valuations are ordered upon H^M 3 per-cent and H^M 4 per-cent bases, the following results will appear:

Taking first the low rates—H^M 3 per-cent. H^M 3 per-cent net premium valuation will reserve the whole of the loading, and to the world at large, without an examination of the actual premiums, the valuation would be declared eminently satisfactory and upon the strongest basis and soundest principles. The actual result, however, would be that the reserve made for future expenses

TABLE E.—*Lowest Premiums.*—H^M *Valuation, 3 per-cent.*

Net Premium Valuation						Gross Premium Valuation					
Age	Gross Premium	Net Premium	Loading	Expenses 5*s.* and 5 %	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	$22\frac{1}{2}$ % Reserve for Expenses and Profits	Premium as Valued	Expenses	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	Negative Values for — Years	Age
20	1·729	1·427	·302	·336	−·034	·389	1·340	·336	·053	Nil	20
25	1·900	1·625	·275	·345	−·070	·427	1·473	·345	·082	Nil	25
30	2·075	1·879	·196	·354	−·158	·467	1·608	·354	·113	Nil	30
35	2·342	2·193	·149	·377	−·228	·527	1·815	·377	·150	Nil	35
40	2·738	2·589	·149	·387	−·238	·616	2·122	·387	·229	Nil	40
45	3·288	3·114	·174	·414	−·240	·739	2·549	·414	·315	Nil	45
50	3·962	3·800	·162	·448	−·286	·891	3·071	·448	·443	Nil	50
55	4·833	4·725	·108	·492	−·384	1·087	3·746	·492	·595	Nil	55
60	6·088	5.987	·101	·554	−·453	1·369	4·719	·554	·815	Nil	60

TABLE F.—*Lowest Premiums.*—H^M *Valuation*, 4 *per-cent.*

Net Premium Valuation						Gross Premium Valuation					
Age	Gross Premium	Net Premium	Loading	Expenses 5*s.* and 5 %	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	22½ % Reserve for Expenses and Profits	Premium as Valued	Expenses	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	Negative Values for — Years	Age
20	1·729	1·245	·484	·336	·148	·389	1·340	·336	·053	Nil	20
25	1·900	1·428	·472	·345	·127	·427	1·473	·345	·082	Nil	25
30	2·075	1·669	·406	·354	·052	·467	1·608	·354	·113	Nil	30
35	2·342	1·969	·373	·377	−·004	·527	1·815	·377	·150	Nil	35
40	2·738	2·352	·386	·387	−·001	·616	2·122	·387	·229	Nil	40
45	3·288	2·865	·423	·414	·009	·739	2·549	·414	·315	Nil	45
50	3·962	3·542	·420	·448	−·028	·891	3·071	·448	·443	Nil	50
55	4·833	4·458	·375	·492	−·117	1·087	3·746	·492	·595	Nil	55
60	6·088	5·715	·373	·554	−·181	1·369	4·719	·554	·815	Nil	·60

TABLE G.—*Highest Premiums.*—H^{M} *Valuation,* 3 *per-cent.*

Net Premium Valuation						Gross Premium Valuation					
Age	Gross Premium	Net Premium	Loading	Expenses 5s. and 5 %	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	22½ % Reserve for Expenses and Profits	Premium as Valued	Expenses	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	Negative Values for — Years	Age
20	2·179	1·427	·752	·359	·393	·490	1·689	·359	·131	5	20
25	2·404	1·625	·779	·370	·409	·541	1·863	·370	·171	3	25
30	2·671	1·879	·792	·384	·408	·601	2·070	·384	·217	2	30
35	2·992	2·193	·799	·400	·399	·673	2·319	·400	·273	Nil	35
40	3·442	2·589	·853	·412	·441	·774	2·668	·412	·362	Nil	40
45	4·108	3·114	·994	·455	·539	·924	3·184	·455	·469	Nil	45
50	4·962	3·800	1·162	·498	·664	1·116	3·846	·498	·618	Nil	50
55	6·104	4·725	1·379	·555	·824	1·373	4·731	·555	·818	Nil	55
60	7·758	5·987	1·771	·638	1·033	1·745	6·013	·638	1·107	Nil	60

TABLE H.—*Highest Premiums.*—H^M *Valuation, 4 per-cent.*

Net Premium Valuation						Gross Premium Valuation					
Age	Gross Premium	Net Premium	Loading	Expenses 5s. and 5 %	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	22½ % Reserve for Expenses and Profits	Premium as Valued	Expenses	Margin for Profit contained in Premium for each £100. To be Valued for the Remainder of Life	Negative Values for — Years	Age
20	2·179	1·245	·934	·359	·575	·490	1·689	·359	·131	9	20
25	2·404	1·428	·976	·370	·606	·541	1·863	·370	·171	7	25
30	2·671	1·669	1·002	·384	·618	·601	2·070	·384	·217	5	30
35	2·992	1·969	1·023	·400	·623	·673	2·319	·400	·273	3	35
40	3·442	2·352	1·090	·412	·678	·774	2·668	·412	·362	2	40
45	4·108	2·865	1·243	·455	·788	·924	3·184	·455	·469	1	45
50	4·962	3·542	1·420	·498	·922	1·116	3·846	·498	·618	Nil	50
55	6·104	4·458	1·646	·555	1·091	1·373	4·731	·555	·818	Nil	55
60	7·758	5·715	2·043	·638	1·405	1·745	6·013	·638	1·107	Nil	60

and profits is not sufficient under certain policies even to pay expenses, and that upon such a basis there would be a deficiency instead of a surplus for future profits. A gross premium valuation, on the other hand, although by many not considered satisfactory, would deal with the actual facts, and, reserving 22½ per-cent of the gross premiums, would not only provide for future expenses, but also leave a margin for profit, and no negative values would be included in the valuation.

H^M 4 per-cent valuation with the low rates would similarly, under a net premium valuation, leave an insufficient reserve even for expenses for all policies entering at age 35 and upwards, and would leave but a very trifling margin for profits only at ages below 30 at entry.

A gross premium valuation, H^M 4 per-cent, would, on the other hand, be much more satisfactory, and make the necessary reserves for both expenses and profits.

Taking next the high rates. H^M 3 per-cent net premium valuation will reserve a good margin throughout for profit after setting aside the proper sum for expenses. This margin for profit will be larger as the age at entry increases, and the whole loading being reserved throughout, there can be no anticipation of future profits and no negative values contained on the results.

A gross premium valuation, on the other hand, while reserving the same amount for expenses, and leaving throughout a margin for profit, will show a much smaller reserve under the policies for the younger ages at entry. It would also, on these policies, anticipate a large amount of the future profits, and all policies entered at age 20 will include for a period of five years negative values; for ages at entry 25 the values will be negative for three years; and for age 30 for two years. From 35 upwards there will be no negative values, but the reserves for profit will be less throughout than under a net premium valuation for all lives entering up to the age of 55.

H^M 4 per-cent will also be satisfactory under a net premium valuation, but under a gross premium valuation, with reserve of 22½ per-cent, a still larger number of negative values would be included, and for policies below 30 for a period of from five to nine years' duration, and a very large amount of the future profits will be anticipated.

I think these examples are amply sufficient to prove that the actual rates charged may have a most important influence upon the results brought out by a valuation. It will, of course, be very naturally said, that in these examples I have departed from actual

facts to build up two theoretical offices which, in fact, do not exist. That is true, but I wish to make it clear that while the whole of the cases do not exist *together* in any one office, they do in fact all exist somewhere or other in actual practice, for the examples are taken from actual rates charged, and whenever those rates come into the valuations of any office the results, as regards all policies for the same ages at entry, must be the same, although, as already pointed out, the individual cases may be neutralized by the effect of average.

In order, however, to make the matter more practical, let us suppose for a moment several offices, take promiscuously Nos. 5, 19, 48, 52, 53, have to be valued by H^M 3 per-cent, and that Nos. 1, 16, 37, 35 and 45, have to be valued by H^M 4 per-cent. The following tables will show what proportion of premiums will be reserved, and what margin there is for profit under both gross and net premium valuations for the different ages at entry.

TABLE I.—H^M 3 *per-cent Valuation.*

Office	Age at Entry	Net Premium Valuation			Gross Premium Valuation—22½ %		
		Proportion of Premium Reserve for Profit and Expenses	Required for Expenses, 5s. and 5 %	Margin for Profit	Proportion of Premium Reserve for Profit and Expenses	Required for Expenses, 5s. and 5 %	Margin for Profit
5	20	·356	·339	·017	·401	·339	·062
	30	·196	·354	−·158	·467	·354	·113
	40	·149	·387	−·238	·616	·387	·229
	50	·279	·454	−·175	·918	·454	·464
	60	·342	·566	−·224	1·424	·566	·858
19	20	·461	·344	·117	·425	·344	·081
	30	·563	·372	·191	·549	·372	·177
	40	·744	·417	·327	·750	·417	·333
	50	1·096	·495	·601	1·102	·495	·607
	60	1·771	·638	1·133	1·746	·638	1·108
48	20	·648	·354	·294	·467	·354	·113
	30	·638	·376	·262	·566	·376	·190
	40	·636	·411	·225	·726	·411	·315
	50	·662	·473	·189	1·004	·473	·531
	60	·738	·586	·152	1·513	·586	·927
52	20	·723	·358	·365	·484	·358	·126
	30	·709	·379	·330	·582	·379	·203
	40	·723	·416	·307	·745	·416	·329
	50	·654	·472	·182	1·002	·472	·530
	60	·330	·566	−·236	1·421	·566	·855
53	20	·752	·359	·393	·490	·359	·131
	30	·792	·384	·408	·601	·384	·217
	40	·807	·420	·387	·764	·420	·344
	50	·733	·477	·256	1·020	·477	·543
	60	·380	·568	−·188	1·433	·568	·865

TABLE J.—H^{M} 4 *per-cent Valuation.*

Office	Age at Entry	Net Premium Valuation			Gross Premium Valuation		
		Proportion of Premium Reserve for Profit and Expenses	Required for Expenses, 5*s.* and 5 °/₀	Margin for Profit	Proportion of Premium Reserve for Profit and Expenses, 22½ °/₀	Required for Expenses, 5*s.* and 5 °/₀	Margin for Profit
1	20	·218	·323	−·105	·329	·323	·006
	30	·160	·342	−·182	·412	·342	·070
	40	·127	·374	−·247	·558	·374	·174
	50	−·004	·427	−·431	·796	·427	·369
	60	−·357	·518	−·875	1·206	·518	·688
16	20	·631	·344	·287	·422	·344	·078
	30	·619	·364	·255	·515	·364	·151
	40	·552	·395	·157	·653	·395	·258
	50	·420	·448	−·028	·891	·448	·443
	60	·373	·554	−·181	1·370	·554	·816
37	20	·723	·348	·375	·442	·348	·096
	30	·839	·375	·464	·564	·375	·189
	40	·960	·416	·544	·745	·416	·329
	50	1·012	·478	·534	1·025	·473	·547
	60	·877	·589	·288	1·483	·589	·894
39	20	·735	·349	·386	·445	·349	·096
	30	·810	·375	·435	·558	·375	·183
	40	·940	·415	·525	·741	·415	·326
	50	1·187	·486	·701	1·064	·486	·578
	60	1·585	·615	·970	1·642	·615	1·027
45	20	·802	·352	·450	·460	·352	·108
	30	·893	·378	·515	·576	·378	·188
	40	·952	·415	·537	·743	·415	·328
	50	·912	·473	·439	1·002	·473	·529
	60	·652	·568	·084	1·432	·568	·864

These figures are enough, without further comment, to show how important it is that the actual premiums charged should be considered, and they also point to the value of a classification of policies according to age at entry, by which means the proportion of policies having a heavy or light loading could be ascertained, and any necessary adjustment made, and the proportion of lives entering at the different ages and existing at the date of a valuation can then easily be ascertained.

My observations have shown, as existing in an office three-quarters of a century old, out of a total number,

8 per-cent,	who entered	under age	20
21	,,	,,	20–30
32	,,	,,	30–40
23	,,	,,	40–50
16	,,	,,	50 and upwards.

and at the close of a year the new entrants for the year were, out of a total number,

8 per-cent,	age at entry,		20
29	,,	,,	20–30
33	,,	,,	30–40
19	,,	,,	40–50
11	,,	,,	50 and upwards.

These figures show that as the loading varies at different ages, so it is important to consider the amount insured for the respective ages at entry.

Should the foregoing deductions be considered useful, I purpose, in the second part of my paper, grouping the several offices adopting the same basis of valuation, showing separately the reserves made for future profits, and comparing them with the different methods of distributing the same.

Discussion.

The Chairman (Mr. G. Humphreys) having briefly invited discussion,

Mr. A. H. Bailey, remarking upon Mr. Crisford's statement, that there were two opposite schools of opinion, which advocated the pure premium method and the gross premium method respectively, said that there was a third method, which was the chief method in use some years ago, and that was the re-assurance method. This might be defined by saying, that the proper method of valuing the liability of any assurance is to take the difference between the actual premium at the present age and at the age of entry, and multiply that by the value of the annuity at the present age, such annuity-value corresponding to the premium charged. That was formerly the only method. He mentioned that because it had an effect on the premiums actually charged. The influence of the Northampton Table on the premiums actually charged had never received the attention it deserved. The peculiarity of the Northampton Table was, that the premiums at the younger ages were too high, while at the older ages they were insufficient, and if Mr. Crisford had extended his tables (A and B) five years further, up to 65, he thought it would have been found, that compared with the H^M 3 per-cent pure premiums at the age of 25, the Northampton premium showed a loading of about 50 per-cent; whereas, at the age of 65, the H^M and Northampton Tables practically corresponded. Between those two ages the limits of the loading were 50 per-cent and zero. Mr. Crisford had spoken of some offices changing their rates of premium at will. But rates of premium always had been and always must be regulated by competition, and at the present time they could not get at the older ages (60 and above) rates of premium to yield the same profit as at the younger and middle ages. The question was,

practically, not what rates they thought most suitable, but what they could get with the competition that existed. No mention was made by Mr. Crisford of the re-assurance method as bearing on the subject under discussion. Mr. Jellicoe had dwelt very much on the transition from the re-assurance mode of valuation to what he called the true method of valuation, but this was not what was called—and often improperly so—the pure premium method. Mr. Jellicoe insisted that valuations should be based on the rates of mortality and interest which really prevailed. A good many of the pure premium valuations, as a study of the Board of Trade returns would show, were, however, not pure premium valuations at all. He had discovered one company that employed no less than four different rates of interest, and it was a common practice for companies to value the sums assured at one rate of interest and bonus additions at another; the with-profit policies at one rate and non-profit policies at another. Annuities were also often valued at a different rate. In such cases there was no notion of what was the pure premium, by which was meant the real prime cost of the assurance. These so-called pure premiums were merely arbitrary reductions of gross premiums. He was, therefore, more than ever disposed to side with Mr. Crisford, when he said: "That no valuation can give proper information about "the position of an office which does not give the present value of the "premiums which are actually payable. Then you will know what "the present value of the deduction is". He could not agree, that the general body of companies spent very much the same proportionate amount annually. That was quite at variance with the facts. He, however, agreed with the author, that although the expenses might, for the sake of comparison, be divided into new business expenses and renewal expenses, a heavier charge upon the new premiums virtually resolved itself into a percentage upon the premiums spread over future years, or taken out of future loadings. He could not refrain from thinking, that so long as a uniform annual premium was charged, the only proper comparison of the total expenses was with the annual premium income. It would, theoretically, be far more just to charge a man in the first instance a considerably higher premium for the first year than for the subsequent years. Formerly, there was an entrance fee charged, but that had passed into disuse, and he did not think any one believed it could be re-introduced. But, under the present system, what remained of the first premium, after the initial expenses were paid, was often insufficient for the risk; and if no renewal premium was paid, the business would result in a loss. As a matter of principle, he thought that the constant percentage for general expenses should be per policy, and not on the sum assured. A constant percentage on the sum assured was, he believed, a mistake. Mr. Crisford said: "It cannot cost more to manage the business for a "£100 policy, whether the life is 20, 40, or 60, after the payment of "commission is paid for"; but he (Mr. Bailey) said, that it did not cost more to manage the business of a £5,000 policy than a £100 policy.

Mr. George King said, that with regard to the question of valuation there were three elements which hung together, and which should not be separated. They were the premiums charged, the

method of valuation, and the method of distribution of surplus. It would be found stated in various papers published in the *Journal*, that certain methods of division were unfair, and that certain methods were fair. He could not agree with that. Almost all the methods of distribution could be made perfectly equitable if the premiums were primarily adjusted, and if the valuation were made to correspond. On the other hand, any method could be made very inequitable if they did not have suitably adjusted premiums, and if they did not value accordingly. For instance, it was a very plausible argument to say that they ought to divide the profits in proportion to the loading of the premiums, if the premiums were loaded approximately by a percentage. That seemed fair, but was not so. It depended altogether on the valuation. If they valued at 3 per-cent and made $4\frac{1}{2}$ per-cent on the fund, it was altogether unfair. He quite agreed with the previous speaker, that they could hardly speak of net premiums by 3 per-cent or 4 per-cent tables. The pure premium in any valuation meant prime cost. Mr. Crisford had, he thought, been led into a fallacy by speaking of the pure premiums of these various tables. When comparing the 3 per-cent valuation with the 4 per-cent valuation he seemed to imply that, because the percentage of loading reserved by a 4 per-cent valuation was higher than by a 3 per-cent valuation; therefore, there was a larger reserve made. But that was not so. The valuation at 3 per-cent made a much larger reserve than the one at 4 per-cent. In fact, all through the paper, the reserve of interest was forgotten; although it was, of course, an extremely important factor. He did not think the H^M Table a suitable one on which to calculate the loading, or what loading had been reserved. For valuation purposes they might very properly take the H^M Table of premiums; and they thus obtained an average, but they could not defend the process when applied to the ages of entry individually. It had been clearly shown that the H^M Table charged too low premiums for the younger ages and too high for the old. So much so was that the case, that it would, he thought, throw out the percentages that Mr. Crisford had tabulated. They could, however, now find out, with tolerable accuracy, from Mr. Sprague's select mortality tables, what were the true risk premiums.

Mr. J. Whitcher said, that he felt it rather difficult to give any decided opinion upon an introductory paper, but thought Mr. Crisford had put forward a great number of results that were based on theories which were certainly new. He was inclined to think that it was unfortunate that Mr. Crisford had taken the H^M 3 per-cent pure premiums to work upon. As had been very rightly observed, they had been proved to be certainly too low at the younger ages, and too heavy at the higher ages. The result that Mr. Crisford has arrived at in Table A had not established anything beyond what was already known—that the tables of premiums charged by any office are fixed by no law of mortality, but chiefly by competition in the open market. While Mr. Crisford had wanted to produce practical results apart from theory, he had yet constantly been obliged to make deductions from general averages. Until they could arrive at some details which were at present unknown, he did not see how they could put aside the results of average investigations. Therefore, it was not of so much

importance whether the loading at any individual age was too little or too great, so long as the whole loading on the total premiums received from year to year amounted to the same as the correct theoretical loadings. The essence, or main object, of a valuation was to find out what they had got in hand, and what they could distribute.

Mr. James Chisholm said that, although they all knew that there were considerable differences in the rates of premiums charged, he did not think the differences were realized to be as great as Mr. Crisford's Table B showed. The great difference between the highest and lowest rates at almost all ages seemed rather to weigh against the statement that the rates were always governed by competition. There must be something more than competition at work, otherwise these differences would not be so great; and one of the chief points in which Mr. Crisford's paper would be interesting, when completed, would be in showing the reason and justification for these differences. He would have preferred if Mr. Crisford, instead of taking the H^M premium as the basis of his argument, had taken the correct risk premium—the premium arrived at from Mr. Sprague's Select-Life Tables. Unless they dealt with the risk premiums, they were rather in doubt as to what could be done with the margins, and how far they were able, at each age, to meet the increasing liability involved in the special manner in which the bonuses were distributed. He had taken, as an illustration, office No. 44, which showed a nearly constant margin at all ages, according to Mr. Crisford's Table B. The margins were there stated to be—Age 20, margin 8*s.* 11*d.*; 25, 9*s.* 3*d.*; 30, 9*s.* 4*d.*; 35, 9*s.* 5*d.*; 40, 9*s.* 8*d.*; 45, 9*s.* 9*d.*; 50, 9*s.* 10*d.*; 55, 9*s.* 4*d.*; 60, 8*s.* 1*d.* But when they dealt with the H^M risk premiums, derived from Mr. Sprague's Select-Life Tables, the margins came out as follows:—Age 20, margin 6*s.*; 25, 7*s.* 4*d.*; 30, 8*s.* 5*d.*; 35, 9*s.* 2*d.*; 40, 9*s.* 6*d.*; 45, 10*s.*; 50, 10*s.* 11*d.*; 55, 11*s.* 6*d.*; 60, 13*s.* 4*d.*, showing quite a different law of progression, and the bonus that they would provide for would, consequently, be very different also. A similar result would follow in Table C if the risk premiums were substituted. They would then find that, instead of the margins for profit being as Mr. Crisford had represented them to be, the lowest rates charged came out almost uniformly as the cost price of insurance, without leaving either any margin for profit or deficiency.

Mr. H. W. Manly observed, that he was astonished to see the remarkable difference between the premiums charged, and still more astonished to find the results which Mr. Crisford had brought out in Table C. The tendency of recent competition seemed to be to reduce the premiums. They were getting down very low, and certainly some were approaching very close to this minimum scale. Unless, therefore, there should be some remarkable profit obtainable from extraneous sources—such as from a higher rate of interest being realized than was anticipated, or from a very favourable death-rate—then it appeared that such an office would not have a very long life. Mr. Crisford's treatment of the subject brought to mind Mr. Meikle's paper (*J.I.A.* xi, 241), in which he showed how the values of the policies could be found by the retrospective method—that is to say, by building up the fund, and showing that the fund if divided at any period among the survivors would give exactly the reserve values of the policies. If

that process were carried a little further, they would be able to find out more clearly than Mr. Crisford had done, what margin there really was for profit and expenses. Assuming that the lives followed a certain rate of mortality (say the H^M rate), they would build up the fund according to the gross premiums charged and the actual rate of interest which was realized by the office upon the funds, and then deducted the actual expenses. They would then find out what amount they had in hand, and how it could be dealt with. He hoped Mr. Crisford, in his future paper, would show how the fund would stand if built up from the actual premiums, using the actual rate of mortality, the actual rate of interest, and the actual rate of expenditure which prevailed in life assurance offices in the present day.

The Chairman (Mr. G. Humphreys), in proposing a vote of thanks to the author, said that they would all recognize the absolute necessity of adjusting theory to practice, although it must be borne in mind that they would have a very ill-defined practice, unless they had sound theory for their foundation. A good deal had been said about competition, but he did not think competition had quite so much to answer for as had been stated. He was inclined to agree with Mr. Bailey about the addition for expenses being charged upon the sum assured. Perhaps upon the whole Mr. Crisford's was a fair way of dealing with the matter, although the right way would be to have a constant addition per policy, as it did not cost any more to manage a £1,000 policy than a £100 policy.

Mr. Crisford, in reply, said that when he referred to the two opposite methods of valuation he meant, that if they turned to the Board of Trade accounts they would find two general bases of valuation —the net and gross premium methods. He did not forget the re-assurance method, but had great difficulty in dealing with that for this reason. The re-assurance method might bring out a value sometimes greater and sometimes less than the net premium method of valuation; the result depending entirely on the mode by which the premium was loaded. If by a constant, it was less at some ages. If by a percentage, it would be greater. It would, therefore, be impossible to deal with the re-assurance method in a general paper, because the premiums were so differently loaded—some irregularly, and some almost by a constant. Mr. Bailey had referred to the Northampton Table. It was perfectly true that at the younger ages the loading was very heavy, and beyond the age of 60, it was less, absolutely, than the pure rates of the H^M Tables. But he was not aware that any office now charged those pure rates exactly. He expected they usually adjusted them for the older ages. He did not think premiums were altogether ruled by competition, as would be proved by the rate of premiums charged by the different companies, and by the amount of new business transacted by the different companies. Often an office charging very high premiums indeed, would secure a large amount of business, because it might have some very special method of distribution of profits. The three points he desired to bring out were —that the premiums charged, the basis of valuation, and the method of distribution, had to go hand in hand. With regard to expenses, it was true that there were some offices which spent more than a reasonable amount, and some whose expenses were exceptionally low.

But the expenses, in a majority of the offices, ranged from 10 per-cent to 15 per-cent on the premium income. He quite agreed with Mr. Bailey, with respect to the proper constant addition to the premium being so much per policy, but in practice it would be almost impossible to charge so much per policy, and for that reason he took the sum assured as his basis. Mr. King and Mr. Chisholm had mentioned the very important point, that had he taken the risk premiums as brought out by Mr. Sprague's Select Mortality Table, instead of taking the H^M pure premiums, he would have shown quite a different margin for profit. In regard to that, he might ask how many offices adopted the select mortality table in their valuation? If an office really adopted these tables, then such results would come out; but in the Board of Trade returns he found that the H^M Table, pure and simple, was very generally adopted, and that it was the exception, rather than the rule, where the pure risk premium was taken into consideration in the valuation. It was because it was the actual basis adopted as shown in the Board of Trade returns that he confined himself to the H^M Tables, although it was true that those premiums did not actually represent the risk premium. Mr. Manly had drawn attention to Mr. Meikle's paper, which he thought a very important one. If an office were to value—no matter what the premiums were—on the retrospective method, the difference then would be brought clearly to the front, and it would be seen how far the funds did represent a margin of profit, and how far they did not. Although that was a method which was very valuable, he did not think it had ever been adopted in actual practical experience for the purpose of making a valuation for the Board of Trade.

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A.

(*Continued from* p. 133.)

Amicable Society.—We now arrive at the period of the formation of the Fourth Mutual Contribution Life Office established in London. This was designated the *Amicable Society for a Perpetual Assurance;* and it was destined, if not to be perpetual, to live long enough to become famous. It differed in some material respects from its predecessors, the chief distinction being that the contribution to its funds was fixed at £6. 4*s*. per annum. The first 2,000 members to pay, in addition, 5*s*. to the registrar and 5*s*. to the joint stock of the office; and all subsequent members were to pay 10*s*. to the joint stock. The founder and the registrar of the society was John Hartley; and he was to receive, permanently, 1*s*. per quarter out of each contribution.

The plan of working was this: the number of members was to be 2,000. Amongst those who died in the first year *one-sixth* of the total contributions was to be divided; in the second year, if the full number of members were enrolled, £4,000 was to be divided; in the third year, £6,000; in the fourth, £8,000; in the fifth, £10,000; and so on for ever afterwards—with a proportionate reduction if the full number of members were not enrolled. The full contribution from the complete roll of members would be £12,000 per annum; the undivided surplus was to accumulate, together with the proceeds from the sale of annuities—a new feature in Life Assurance. The uncertain element was the amount that would be realized for the fixed contribution. This depended entirely upon the number of deaths during the year, the sum appropriated for annual division being equally divided by the number of deaths. Each person had an interest, therefore, in recommending none but healthy lives. There was no limitation of age for membership in the first instance; but the Court had the power of rejection. Candidates for admission attended before the committee, and were put through a species of cross-examination as to health, habits, &c. There was no medical examination. There were powers to change nominees. The original subscribers were men of good social position, and by their influence obtained, in the following year, a Charter of Incorporation from Queen Anne. This Charter authorized the commencement of business as from 25 March 1706. The association had been formed in the preceding year.

The number of subscribers during the first year was 875, of whom 29 died—a very heavy mortality; only £875 was divided, the proportion of each being therefore £30. 3*s*. 8*d*. only. In the second year the full 2,000 subscribers were enrolled, 96 died, and the share of each was £41. 13*s*. 4*d*. Third year, full number being made up by new entrants; 122 members died, and the £6,000 divided gave £50. 3*s*. 6¼*d*. per share. In the 4th year only 87 deaths; share of funds, £91. 19*s*. 0¾*d*. At that time the accumulated stock had reached £25,000, and the stipulated £10,000 was henceforth annually divided amongst the nominees of deceased members.

This mode of working, which was financially safe, converted the Society into a species of Mortuary Tontine, except that the smaller the number of subscribers dying in each year the better for their nominees. The heavy mortality of the first three years—

the result of an undue anxiety to fill up the regulation number—combined with the absence of limit of age and medical selection, caused the speculation to be a very poor one for the representatives of those who died. The established tariff for life assurance amongst the underwriters at Lloyd's and elsewhere, who undertook life risks, was, and long had been, £5 per £100 for one year; here they had paid more and received much less! At a later period, the age of membership was limited to between 12 and 55 years of age.

The *Amicable* had no sooner become established than it was in conflict with the *Society of Assurance for Widows and Orphans.* It was one of those open, old-fashioned fights, wherein each said the worst it could of its opponents, without resorting to actual abuse. The idea of being "perpetual", was greatly ridiculed by the earlier Society. "Perpetual is too great for any humane "undertaking, and especially for one of this nature. This must "be granted if we consider the frailties and vices of men, the "hazard that lies in employing a great stock in order to improve it; "the tricks, the fraudulent combinations and practices which "Companies and Societies are liable to when the temptation is "great." Some of these predictions were in part realized a few years later when, in 1713, Mr. Hartley, the principal officer of the Society, absented himself with some £6,500 of its funds. This event caused great inconvenience and loss of repute to the Society, and was not its only early misfortune. It turned out that some portions of the funds of the Society were invested in Lottery tickets in (I assume) the State Lotteries of 1710 and 1712. Before these events, in 1711, several of the policies of the Society were offered for sale. This was probably the first instance of the sale, or attempted sale, of a Life Policy. There is no record of the price realized. Later still, Insurance brokers advertized that they desired to buy policies in the Society.

It is not my purpose to follow the detailed history of this Association through the entire 160 years during which it carried on business, until in 1866 it was merged into the *Norwich Union* Life Office, under the authority of Parliament. The idea is rather to trace the growth of the successive Institutions founded for carrying on the business of Life Assurance, and indicate their progressive and fundamental differences. In that manner the growth and development of the business may be sufficiently seen. But the changes introduced in the working of this Association are

equally instructive. The Society by its Charter was bound not to deal in bills of exchange, or bullion, or enter into the business of banking, upon the penalty of forfeiture of the Charter. The Office of the Society was at the corner of Dean Street, Fetter Lane. From 1733 a register of assigned policies was to be kept. In 1734 a modification was made in the plan of the Society by the authority of a General Court. A portion of the annual income was to be accumulated with a view of equalizing the amounts payable under policies, *and especially of augmenting the sums whenever the ordinary means of division would yield an amount less than* £100. In 1737 new and more stringent bye-laws were introduced. From 1710 up to 1749, being a period of 39 years, there were 2,967 claims; the sums available for these had amounted to £277,104, giving an average of £93. 3*s*. 7*d*. per claim; but there had probably been very considerable variations in different years. The alteration of 1734 produced greater steadiness. Leaving out the fractions of a pound, the sum of a death-share in 1750 was £132; in 1754, £185; in 1760, £260; 1761, £125, and about the same for several years; 1766, £210; 1768, £148; 1771, £203; 1777, £155; 1786, £303; 1790, £165. Thus there was still a very great variation of amount in different years, rendering the operations very much of the nature of a lottery.

The Society had probably felt the competition of the *Equitable* Society (founded 1762), and its contribution was soon afterwards reduced to £5 per share per annum. In 1770 the Society had an accumulated fund of £33,300, of which £15,000, in Stocks, was set apart, with some minor sources of income, as a fund for augmenting the shares of deceased members to the full sum of £150, whenever they might fall short of that sum under the dividend directed by the Charter. Upon this there was for several years an accession of members. The extreme age for admittance had been reduced to 45. Up to 1774 the Society had paid out to nominees of deceased members £425,060. In 1790 the Society obtained an additional Charter, its third—the second had been obtained in 1730, but had no new feature calling for remark here—under which the number of members might be extended to 4,000 in the whole. The new members were to pay £7. 10*s*. each on admission, and £6. 4*s*. annual contribution. The funds of the Society now consisted of £64,300 in Stocks, and some house property in addition; £30,000 was

appropriated in aid of the future mortuary dividends. Up to 1795 the Society had divided £653,036 amongst the nominees of 5,350 contributors. In 1796 a share of the death sum gave £165; in 1797, £185.

In 1807 a further Charter was obtained by which the working of the Society was a good deal remodelled. *A graduated scale of Contributions was introduced,* according to age and circumstance. Thus at age 15 the premium on admission was £1. 11*s.* 6*d.*; the future annual premium £3. 10*s.* 6*d.*; at age 30 these respective payments were £1. 19*s.* 6*d.* and £4. 19*s.*; at age 40, £2. 5*s.* and £6. 7*s.* 6*d.*; 50, £2. 13*s.* and £8. 12*s.* 6*d.*; 65, £3. 6*s.* 6*d.* and £15. 6*s.*; payments to be made half-yearly. The number of members might be increased up to 8,000, and the death-share compounded for by an annuity. The reserve was calculated to produce £180 per share. In 1836 a further Charter was obtained, by which the number of contributors might be increased to 30,000; the death-share was increased up to £200, insurances might be granted on joint lives, and other than simple risks on life contingencies accepted. There were also provisions regarding periodical valuations, &c. In 1845 further powers were conferred by special Act. A valuation of assets and liabilities was to take place every seven years. By 1854 the funds had increased to £774,245, and there was a balance in favour of the Society, on actuarial valuation, of £109,440. The fixed dividend per share was now £225. 8*s.* But the Society was now retrograding. Hence negociations for amalgamation, commenced in 1864 with the Norwich Union Office, were concluded in 1866 as stated.

It remains to be stated, as part of the essential history of the society, that about 1811 its *Mortality Experience* was compiled by its then registrar, Mr. Pensam, and was found more favourable than that shown by the *Northampton Table.* This was the first actual Mortality Experience of Assured Lives which had been available to Actuaries, and so was regarded with great interest. In 1841 much more complete results of its mortality experience were deduced by Mr. Thomas Galloway, the then registrar.

In order to bring ourselves back to the early part of the eighteenth Century, it is desirable to review the extended purposes to which Life Assurance was capable of being then applied. Here is a summary issued by the founders of the Amicable Society early in its business career:

"1. To Clergymen, Physicians, Surgeons, Lawyers, Tradesmen, and persons possessed of employments for life; and others whose income is usually subject to be determined or lessened at their respective deaths; who by insuring their lives may be morally certain of leaving to their families a claim not less than £100 on each member insured.

"2. To married persons, subsisting upon a jointure, Pension, or other Annuity, determinable upon the life of one of them, by insuring the life of the person entitled to such Annuity, pension, or jointure.

"3. To servants or dependants upon any other person, and thereby entitled to wages, salary, or benefaction during the life of such person; whose life being insured in this Society either by themselves, or by their servants or dependants respectively; in either case such servants or dependants may become entitled to a claim or claims, upon the death of the persons to whom they are servants or dependants.

"4. To persons wanting to borrow money, who by insuring their lives, assigning their policies to, and depositing the same in the hands of their creditors, and paying the contributions growing due thereupon, are unable to give a collateral, and in some respects a real security for the money borrowed.

"5. To *London* merchants and wholesale dealers who upon a similar insurance and deposit may safely entrust with their country chapmen a larger quantity of goods than might otherwise be thought convenient.

"6. To creditors entitled to demands of a higher or larger amount their debtors are able to discharge out of their income; who by a similar insurance and deposit, and by paying (as it were) the interest of their debts, during life, may be enabled to secure to their creditors the principal sums at their deaths."

We now resume the general narrative. In 1707 there was projected by Mr. Charles Povey (a name that will always be remembered in insurance annals as the founder of the *Sun Fire Office,* and the advocate of numerous other projects), a Scheme of Life Assurance, under the title of *The Proprietors of the Traders' Exchange House.* It will be sufficient for our present purposes to give a brief contemporary account of the project, as preserved in Hatton's *New View of London* (1708), thus:

"Every subscriber to pay to the office 2*s.* 6*d.* per quarter (besides the writings) and never more. For which the subscriber shall every quarter have equally divided among the heirs, executors, or nominees of the deceased subscribers that die within any quarter, the sum of £300, and also an halfpenny clear profits out of the *Printed Papers* sold from that office; also that £50 per quarter be disbursed during the term of 5 years for erecting a structure to be called the Traders' Exchange House College, and at the end of these said 5 years, 100 of the subscribers falling to decay are to be admitted into the said college, and 50 of the most necessitous of the 100 shall be allowed £10 per annum for life. And at the decease of Mr. Povey the profits arising by the Traders' Exchange House, and £2,000 per annum

payable by the subscribers to the said house, are to be converted to the proper use of the whole body of subscribers for ever."

This Traders' Exchange House was situated in Hatton Garden, and became very noted during the South Sea mania. The "printed papers" probably refers to a publication called "*The General Remark or Miscellany,* set forth by Mr. Povey, in Covent Garden," and was the precursor of *The Historical Register,* which a few years later was distributed to the subscribers in the *Sun Fire Office.*

This Life Scheme of Povey's actually commenced business; for in a number of the *General Remark* "from Wednesday, 22nd, to Friday, 24th December, 1708", there is a special notice, as follows:

"In the Insurance of Lives there has happened several deaths, and the claims will be paid to the nominees of the said deceased subscribers on Tuesday 6th January following. NOTE.—At Lady-Day next, claims in the Insurance upon Lives will be double to what they were at Michaelmas last, this undertaking so much improves since the publication of Mr. Povey's proposals for insuring goods from loss by fire."

The intended philanthropic features of this scheme have found active imitators in the present Century.

In 1708 elaborate "proposals" were put forth in view of establishing a "*Perpetual Assurance Office,* by a voluntary sub-
" scription of two thousand persons who, for certain annual
" payments into a joint stock during their lives, may and will
" secure to themselves, or to any person or persons they shall
" name (at or before their respective deaths), such advantageous
" sum or sums of money as are hereafter expressed."

The scheme was a most elaborate one, and not deficient in the speculative element, as may be seen from its 1st paragraph, thus:
" 'Tis proposed that this Society shall consist of 2,000 reputed
" healthful persons of either sex. None to be admitted a member
" above 55 years old. Any officer by sea or land, or any other
" person, may name as many members as they please, till the
" number be completed. If A, the husband of E, subscribes, and
" makes E his nominee; and if E, the wife of A, subscribes, and
" constitutes A her nominee; then the survivors will be sure of a
" chance, and their children or friends will reap the benefit of
" both; besides, they'll secure to their posterity two places in this
" Society for ever, unless they or their successors shall think fit to
" dispose of 'em."

This was seen to be such a manifest paraphrase upon the

scheme of the *Amicable* Society, that upon the projectors of this new scheme making an application for a Charter, counsel for the *Amicable* was heard upon it, and the Charter was refused.

In this same year 1708 there was projected and founded the "*Friendly Society* for Assurance of money upon Lives, and for raising a Joint Stock, thereby to secure to the Subscribers the several Benefits and advantages hereinafter mentioned." The place of business was the Rainbow Coffee-House in Cornhill, "where men or women may subscribe on their own or other "persons' lives, for the benefit of themselves, and have them "approved without their knowledge; paying 10*s*. entrance, and "10*s*. towards the first claim, for each life; and shall have a "policy for £1,000 for each life subscribed upon in the said "Society. This office may be proper for such persons as have "annuities, estates, or places for life, and for such persons to "make allowance upon lives where debts are dubious if the person "die. This office will assure money much cheaper than private "persons" — whatever that may mean. The advertisement continued: — "*Note.* — Here is a second Society, paying 5*s*. "entrance, 10*s*. at receipt of the policy towards the first quarterly "dividend, and 10*s*. per quarter afterwards; advantages, when "full, dividend of £1,000, until then proportion. Two thousand "members when full."

The *having* two offices at one address led to a good deal of confusion, not quite unintentional I suspect. I believe, from a reference in the *Harleian Collection*, that the granting a Charter to the Society was also opposed by the *Amicable* Society. The Society lived for some years, became proprietary, and passed through other phases before it finally disappeared.

The second Office at this address was, I believe, *The Office of Assurance* of *money upon Lives*, at the Rainbow Coffee-House in Cornhill.

All through the years 1708-9-10 the newspapers teemed with advertisements of projected schemes of Insurance, of which but comparatively few addressed themselves to Life Assurance alone. It seems desirable briefly to notice those that actually became established, although some of these had but a short career. I shall merely give the names of those which arrived at such a stage of advancement as to secure a distinctive designation, and any marked features of identity. Their first domiciles were usually at coffee-houses or other places of public resort, where their promoters

were able to pull the strings of several enterprises at the same time.

The chief projects of 1708 I have already named. In 1709 there were the following:

1. The *Union Society*, who for 2*s.* 6*d.* for the Policy, 2*s.* 6*d.* for the first quarter, and 2*s.* 6*d.* per quarter afterwards, proposed to pay (in case 4,000 had subscribed) every quarter to the nominees and representatives of deceased persons whose lives were assured and should die within the quarter, £400; "and every "Subscriber desiring the same may have one of the papers they "publish once or twice a-week gratis, &c. And £100 a-year to "be applied in Cloathing, Schooling and Apprenticing poor "Subscribers' Children." Here was Mr. Povey again. We learn no more of this scheme.

2. "The *Taylors' Friendly Society* for Insurance upon the lives of Men, Women and Children," kept at the "Sun and Cross Keys," Witch Street; and at the same address a second Insurance Society, called the *Amicable Society*—another Amicable—where £120 was to be divided quarterly, "and if (the Subscribers be) "overtaken with poverty shall be relieved as in the first Society, "besides several other benefits which are too large here to "mention, shall therefore refer you to the Abstract of the "Settlement which is in print and may be had gratis."

3. The *Monthly Society* of Assurance upon lives, in Bedford Court, Covent Garden—"upon the 22nd November last Trustees "were nominated for the first year, to whom the Master proposed "security above £2,000 value, freehold estate, which they ordered "to be settled by advice of Council forthwith. Note.—Any "healthy person of either sex, between the ages of 10 and 55, may "be entered in the said Society. The charge of which is 10*s.*, "viz., 5*s.* Entrance and 5*s.* toward the monthly dividend," &c.

4. This year also called into existence the first provincial Life Office of which we have any knowledge—the *Berkshire and Counties* Insurance Association, of which the following was an early announcement:

"A Society is established among the Clergy, Yeomen and "Tradesmen of Berks and other Counties, for a provision for the "families of such as have estates only for life, or any other men "or women, by a voluntary fair and easy contribution amongst "themselves, whereby any Subscriber thereto may be entitled to "£600, paying 20/- at the death of the lives that dye before your

" life. If any Subscriber want money, may have half what he or " she have paid, and abate the same and interest when his other " claim is due, which is when the life is dead which you nominated: " or when you have paid £400, though the life be not dead then " you shall have the £600. The life you name must be seen by " one of the Office, which is ready to go when paid by you; a " Clergyman's age may be 65, any other must not exceed the age " of 60, must be approved healthy. The money paid the next " quarter-day after the death of the life at the Clerk's House by " the Subscribers themselves, which will be a gain to all and a loss " to none. The method thereof, together with the articles of " the same at large, are to be seen any Monday at Mr. Field's, at " Hampstead Marshall, near Newbury, in Berks, 15 days before " every Quarter. Notice will be given in the news what is to be " paid the next Quarter-day."

The year 1710 opened more quietly than the previous one, and there were but two Life Assurance projects to notice, namely:

1. Proposals for raising a Bank for private Families and Widows by Subscriptions upon the lives of 3,000 persons, and for making two dividends every quarter among the Claimants. The charge being 1*s.* 6*d.* for the Policies and 2*s.* 6*d.* a-quarter only. The proposals are to be had gratis, at the Office at the Black Boy Coffee-House, in Ave Maria Lane, Ludgate Street.

(To be continued.)

Notes on Friendly-Society Legislation.

With reference to the article appearing on p. 24 of this Volume, we have received a letter from Mr. A. J. Cook, in which he points out "that, under the Friendly Societies' Act of 1875, " a treasurer is *not* bound to give security unless required by the " rules of a society to do so; but that the previous Act (1855) " stipulated that every treasurer must give security. By the " provisions of the last-named Act, agents were liable to criminal " prosecutions for withholding moneys; and many convictions of " the kind are on record". We are glad to give publicity to these corrections.

JOURNAL

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The Rates of Mortality among the Natives of India, as deduced from the recent Census Returns. By George Francis Hardy, F.I.A., F.S.S.

[Read before the Institute, 27 April 1884.]

Having had occasion, in connection with the recent Indian Census, to investigate the question of native mortality as prevailing in the various Indian Provinces, a short statement of the methods employed and the results obtained may perhaps be of interest to the members of the Institute of Actuaries. The problem presented and methods employed belong distinctly to the work of the Actuary, although the results may, perhaps, have more interest for the Statistician.

On 18th February 1881 the first general and simultaneous enumeration was made of the population of India. Many previous enumerations had taken place, but these had been made independently by the Provincial Governments at various times, and were, moreover, even so far as they went, very imperfect; hence it was to be expected that with the knowledge gained by previous experience and with the additional precautions employed to secure

completeness and accuracy, the 1881 Census would throw very considerable light on many subjects connected with the vital statistics of India, and particularly upon the duration of life among the native population generally.

The Census Returns afford almost the only information available for this enquiry, since the method usually employed to obtain the rates of mortality prevailing in a given population by a comparison of the numbers living at the various ages of life as deduced from the Census Returns with the registered deaths at such ages during a year or period of years, cannot be employed in respect of Indian populations on account of the generally untrustworthy character of the registration, although the Registration Returns are still of use as indicating the *relative* mortality of different years. An entirely different method has therefore to be pursued.

Supposing that the actual numbers living at each age could be exactly obtained, these numbers would represent the survivors from a varying and probably very irregular number of births, and in order that they may be made available for deducing a mortality table they must be adjusted to represent as far as possible the age distribution *that would have obtained* had the birth and death rates been constant and rate of increase consequently uniform. When this is done, the adjusted numbers living at the various ages combined with the assumed uniform rate of increase will of course give the usual l_x column of the mortality table. The age tables as given by the Census require, however, a much more drastic graduation than is needed or than would be justified where the Registration Returns can be employed. In this process there are three main points of difficulty to be met.

I.—THE UNCERTAINTY OF THE AGES RETURNED AT THE ENUMERATION.

This uncertainty is notorious even in our own Census Returns, and is a very serious matter in the Indian Returns. It will be best illustrated, perhaps, by quoting the following figures from the North-West Provinces Census Report.

TABLE 1.—*Showing the Ages returned in an Enumerator's Schedule for* 1,000 *Persons in the North-West Provinces.*

Age	Males	Females	Age	Males	Females	Age	Males	Females	Age	Males	Females	Age	Males	Females
0	12	11	20	16	44	40	30	40	60	12	17	80	4	3
1	13	15	21	1	1	41	2	...	61	...	...	81	...	...
2	14	14	22	8	5	42		..	62	...	...	82	...	...
3	17	21	23	2	1	43	1	...	63	...	...	83	...	...
4	9	17	24	4	4	44	...		64	...	...	84	...	...
5	16	13	25	42	46	45	12	16	65	...	...	85	1	...
6	13	9	26	7	6	46	...	...	66	...	...	86	...	...
7	13	17	27	4	3	47	...	...	67	...	...	87	...	...
8	7	10	28	8	3	48	...	1	68	..	...	88	...	...
9	13	9	29	6	8	49	3	...	69	...	.	89	...	...
10	16	11	30	30	26	50	22	29	70	4	5	90	...	1
11	5	5	31	1	1	51	1	...	71	...	...	91	...	...
12	20	17	32	4	4	52	3	1	72	...	1	92	...	...
13	3	5	33	...	1	53	1	...	73	...	...	93	...	...
14	4	6	34	1	1	54	1	..	74	...	...	94	...	...
15	13	10	35	19	17	55	10	4	75	...	...	95	...	...
16	7	16	36	3	3	56	...	...	76	...	...	96	...	...
17	4	4	37	2	2	57	1	...	77	...	...	97	...	...
18	10	7	38	...	...	58	...	...	78	...	...	98	...	...
19	3	2	39	6	1	59	1	...	79	...	...	99	...	...
												100	...	1

It will be seen by a glance at these figures that the numbers given at ages 20, 25, 30, 35, 40, &c., are greatly in excess of the truth, and that in the great bulk of these cases the ages have only been given approximately. The uncertainty is evidently greater as the age increases, so that of 49 persons returned as age 60 and upwards, no less than 45 are returned at the ages 60, 70, and 80.

From the fact that in the 1881 Census the ages *last birthday* were taken, and in previous enumerations the *ages next birthday*, there is throughout India a large apparent increase in the number of old people. The explanation of this is very simple. According to the above scheme the numbers living over 60 out of a population of 1,000 were, in 1881, 49. Had the ages last birthday been taken, however, there is no doubt that the numbers actually scheduled at age 60 would have been exactly the same; they would, however, have been finally returned as *under* 60, and the numbers living at age 60 and upwards would have appeared as 20 only. In other words, while no actual alteration would have taken place, there would have been an apparent increase at these ages of nearly 150 per-cent. From this it will readily be understood that although (for example) we have, in Madras, in 1881, 4·9 per-cent of the population returned as above 60, as against 3·1 per-cent

in 1871, so far from inferring an increase in the proportion of old people, it is quite probable that these numbers point to an actual diminution.

This difference in recording the ages at the last as compared with previous enumerations, fortunately has the effect of largely meeting the difficulty under consideration, since by taking a mean between the age distributions as given by the two Censuses, the excess at the decennial ages is spread equally over the adjacent groups, and the error arising from this source is immensely reduced. This point may be illustrated by the age tables of the Madras Census of 1871 and 1881. The following table shows the distribution by age of 1,000 males according to the returns of these dates, and that given by a mean between the two enumerations. It will be seen that while the decrements for each Census taken alone are most irregular, those of the mean figures are not so to anything like the same extent, being, with one exception, all negative.

TABLE 2.—(MADRAS)—*Age Distribution of* 1,000 *Males,* 1871–1881.

Ages	1871			1881			MEAN		
	Nos.	Δ	Δ^2	Nos.	Δ	Δ^2	Nos.	Δ	Δ
0– 5	181	−32	−23	124	14	−20	153	− 9	−23
5–10	149	−57	71	138	− 6	−39	144	−32	17
10–15	92	14	−36	132	−45	40	112	−15	1
15–20	106	−22	32	87	− 5	6	97	−14	19
20–25	84	10	−50	82	1	5	83	5	−22
25–30	94	−40	59	83	6	−36	88	−17	12
30–35	54	19	−58	89	−30	36	71	− 5	−12
35–40	73	−39	55	59	6	−38	66	−17	10
40–45	34	16	−48	65	−32	41	49	− 7	− 1
45–50	50	−32	48	33	9	−34	42	− 8	3
50–55	18	16	...	42	−25	...	30	− 5	...
55–60	34	...	...	17	...	...	25	...	...
60 & over	31	...	...	49	...	...	40	...	...

With reference to these figures, a further point of some importance may be noticed. It will be seen that taking the ages from 25 upwards the second differences in 1871 are in each group of opposite sign to those of 1881, and are also of somewhat greater magnitude. Now these second differences in 1871 are mainly due to the numbers returned at ages 30, 40, 50, and 60, who in reality belonged to older ages (the enumeration being then by age next birthday, and the lives returned at 40, 50, &c., being included in

the groups 35–40, 45–50, &c.). In 1881, however (when the numbers at these ages were included in the groups 40–45, 50–55, &c.), the disturbance in the progression was mainly due to those lives returned at the decennial ages who as a matter of fact were among the younger. Keeping in mind this consideration, we may infer, with considerable approach to certainty, from the greater magnitude of the 1871 second differences, that the larger proportion of these roughly stated ages were under-stated; that is, the lives enumerated above 30 were, on the whole, *older* than the Census returns would indicate.

II.—The Uncertainty as to the Rates of Increase.

This uncertainty is caused by the imperfection of the previous enumerations, which in many districts would show, when compared with the recent Census, an increase of population beyond all possibility. In Madras the enumerations have been more frequent than in any other portion of the Empire, and may therefore be considered as, on the whole, more trustworthy. Yet, as Mr. McIver shows in the Census Report for Madras (1881), the 1871 Census was defective as regards the floating population to the extent of the omission of about 500,000 persons (of whom 360,000 were males). Although, therefore, periodical Census Returns in Madras go back to 1856, it would be useless to compare the then population with the 1881 returns with a view of determining the rate of increase during the period. Probably the 1871 and 1872 enumerations in the different provinces were, on the whole, fairly complete, with the exception of the floating populations, and it is mainly upon these that the mean rates of increase have been based, corrections being introduced to allow for the effect of the late famine.

III.—The Disturbing Effect of Famines.

This effect is twofold. In the first place, the death-rate is naturally increased, and this frequently to an appalling extent, and in the case of the 1876–8 famine the mortality was so great in some districts, that entire provinces, such as Madras, Mysore, &c., show a large decrease of population during the decade 1871–1881. The birth-rate, moreover, is affected to an equally remarkable extent, being throughout the duration of the scarcity much below the normal amount. The effect of the recent famine in this respect may be strikingly seen by a comparison of the

number of children under 5 enumerated in 1871 and 1881, the former Census following a period of exceptional prosperity, the latter a very severe famine. The following table shows the proportion of young children at each enumeration for the principal divisions of India.

TABLE 3.—*Children under* 5 *in* 10,000 *Persons.*

Province	1871-2	1881
Madras	1,843	1,265
Bombay	1,866	1,321
Central Provinces . . .	1,840	1,695
Bengal	1,696	1,465
N. W. Provinces . . .	1,652	1,267
England	1,352	1,356

The effect of famines is, consequently, to introduce great irregularities in the age distribution, there being a paucity of numbers in all those groups representing survivors from the births of a famine period. For example, the numbers living in Madras between the ages of 20 and 30 at the time of the last Census would no doubt be considerably below the average proportion at these ages, since they represented the survivors of births from 1851–1861, a period which included the severe famine of 1856. This point has, of course, to be kept in view in adjusting the numbers returned at the various ages.

The question of emigration did not prove troublesome. Its extent was quite unimportant, and practically affected only the Madras population, where there appeared to have been an average rate of emigration among the male population of about one per mille per annum, or only one per-cent in 10 years. In the Punjab immigration to about the same slight extent appears to have been steadily in progress.

But for the existence of certain special statistics referring to the so-called "Proclaimed Clans" of the North-West Provinces, the determination of the mortality in childhood would have been a matter of great difficulty. Fortunately, however, these returns are fairly complete, being collected under police supervision, under the Act of 1870 for the suppression of infanticide. These returns give the numbers under observation each year for all ages under 12, distinguishing male and female children, and the number of deaths at each age. The returns, however, require some modification before they can be made available for determining the rates of

mortality. The numbers returned as under observation, below one year of age, consist simply of those born during the year of observation, and the deaths under one year are such of these as die before completing the year of observation (not the first year of age). These deaths, therefore, are to be taken in respect of an exposure of only about six months on the average. Similarly the numbers returned as between 1 and 2 are the survivors of those born in the preceding year of observation, and would therefore more properly be returned as aged from 6 to 18 months (assuming the births to take place on the average in the middle of the year). Hence the numbers returned as aged 1, 2, 3, &c., at the commencement of each year of observation would be those who, at a Census, would be returned as from 0–1, 1–2, 2–3, &c.

The following table represents the mortality experience of these clans from 1876–1882, comprising altogether about 100,000 deaths.

TABLE 4.—*Mortality Experience of the Proclaimed Clans (North-West Provinces)*, 1876–82. *Deaths out of* 10,000 *at risk during the first* 12 *Years of Life.*

Year (ending 1st April)	0–1	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–12
Males												
1876–77	2,379	745	329	201	170	146	94	87	69	68	64	50
1877–78	2,371	771	358	223	204	135	106	96	66	69	57	55
1878–79	2,032	1,411	961	519	371	282	221	144	114	97	102	75
1879–80	3,161	2,529	1,561	1,218	951	709	641	452	412	353	268	396
1880–81	1,949	1,376	807	417	296	243	189	122	135	114	118	121
1881–82	2,109	1,168	701	459	311	231	218	186	106	91	113	127
Mean ...	2,334	1,333	786	506	384	291	245	181	150	132	120	137
Females												
1876–77	2,230	827	394	286	233	182	132	133	96	46	71	62
1877–78	2,637	976	478	368	223	267	188	160	82	135	143	43
1878–79	2,112	1,576	1,281	750	424	344	257	210	162	112	117	84
1879–80	3,258	3,000	2,424	1,711	1,214	936	719	662	596	534	372	411
1880–81	1,920	1,408	1,024	635	430	254	252	187	194	92	173	408
1881–82	2,114	1,270	1,018	760	608	357	244	214	183	115	141	349
Mean ...	2,378	1,509	1,103	752	522	390	299	266	219	172	170	226

It will be seen that there is a considerable difference between the mortality of the two sexes. Considering, however, the character of the community and the object of the enforced registration, no importance can be attached to the excess of mortality among the female children. The rates of mortality among the male children are not open to any similar suspicion, and as these clans consist on the whole of tolerably prosperous communities, the figures here given probably do not exaggerate the general mortality of native male children. The mortality differs considerably in various years, and was extremely heavy in 1879–1880. As this year was probably exceptional, a weight was given to it equal only to one-tenth of the entire experience. From the rates thus modified resulted the following mortality table (males), from age 1 to 12, the figures being slightly adjusted.

TABLE 5.—*Proclaimed Clans Mortality Experience (Males) Survivors out of* 100,000 *Births.*

Ages	Adjusted Numbers		Original Experience		Life Table		
	Populations	Decrements	Populations	Decrements	Ages	Living	Dying
At birth . .	100,000	22,673	100,000	22,673	0	100,000	28,275
Living, ages 0– 1	77,327	9,570	77,327	9,570	1	71,725	6,616
„ „ 1– 2	67,757	4,764	67,757	4,906	2	65,109	3,699
„ „ 2– 3	62,993	2,931	62,851	2,822	3	61,410	2,451
„ „ 3– 4	60,062	2,037	60,029	2,029	4	58,959	1,725
„ „ 4– 5	58,025	1,503	58,000	1,496	5	57,234	1,309
„ „ 5– 6	56,522	1,146	56,504	1,203	6	55,925	1,013
„ „ 6– 7	55,376	899	55,301	885	7	54,912	806
„ „ 7– 8	54,477	733	54,416	702	8	54,106	677
„ „ 8– 9	53,744	627	53,714	612	9	53,429	595
„ „ 9–10	53,117	566	53,102	574	10	52,834	551
„ „ 10–11	52,551	540	52,528	614	11	52,283	542
„ „ 11–12	52,011	...	51,914	...	12	51,741	...

The numbers surviving to the exact ages 1, 2, 3, in the life tables were obtained by interpolating between the figures in columns, giving the survivors living between 0–1, 1–2, &c. It was assumed in the subsequent steps that these figures would fairly represent the mortality during childhood in normal, *i.e.*, non-famine periods throughout India. It may be of interest to compare these rates of mortality with those prevailing in this country, and with those found by Messrs. Brown and Finlaison among European children in India.

TABLE 6.—*Rates of Mortality in Childhood.*

Ages	Mortality per-cent							
	Proclaimed Clans		Uncovenanted Service Experience (A. J. Finlaison)		Children of Europeans (S. Brown)		English Life Table, No. 3	
	Males	Females*	Males	Females	Males	Females	Males	Females
0	28·27	24·12	13·80	7·82	8·62	7·67	16·36	13·47
1	9·23	8·03	6·60	7·80	7·24	6·76	6·43	6·19
2	5·68	5·02	2·76	2·85	3·17	3·68	3·55	3·54
3	3·99	3·59	1·92	1·75	1·60	1·87	2·38	2·42
4	2·93	2·68	·65	·98	·79	1·14	1·78	1·77
5–9	1·60	1·53	·58	·64	·51	·58	·84	·82

* NOTE.—These figures are modified as explained later on.

It now remains to explain the further steps employed in adjusting the age tables and in determining the average rates of increase in the various provinces. For this purpose the Province of Madras was first dealt with, as affording the most complete and trustworthy returns. Since, however, this province suffered exceptionally in 1876–8 famine, it was thought desirable in the first instance to select five districts in which the famine had been least felt, and which, at the same time, were known to be practically free from the influence of emigration. These districts were Ganjam, Vizagapatam, Godaveri, South Canara, and Malabar. The question as to whether, during the famine, any migration from famine to non-famine districts had taken place which would affect the returns was settled in the negative by the birthplace returns in the various Madras districts. The following figures will show that the effect of migration must have been practically *nil.*

TABLE 7.—*Birth-place of Madras Population,* 1881.

Living in	Born in			
	Five Districts		Remaining Districts	
	Males	Females	Males	Females
Five Districts . .	4,106,508	4,188,338	28,603	24,327
Remaining Districts	16,483	14,210	10,450,718	10,712,930

The male population in these districts in November, 1871, and February, 1881, respectively was as follows.

TABLE 8.—*Madras (Selected Districts) Males enumerated in* 1871–1881.

Ages	MALE POPULATION	
	November 1871	February 1881
0– 5	749,836	578,306
5–10	650,185	609,231
10–15	404,228	549,584
15–20	468,881	365,825
20–25	349,879	335,729
25–30	387,570	346,184
30–35	206,425	357,222
35–40	306,177	212,096
40–45	118,610	269,477
45–50	198,447	117,567
50–55	59,915	177,004
55–60	126,097	57,628
60 and over	102,635	189,582
Total	4,128,885	4,165,435

As already stated the floating population was badly counted in 1871, and the figures given above for 1871 include 90,705 added to meet the estimated deficiency under this head, this corresponding to the proportion found to prevail in the province generally. There was, therefore, an estimated increase of population during the $9\frac{1}{4}$ years (9·26) intervening between the enumerations of 1871 to 1881 of ·885 per-cent, or about 1 per mille per annum. In other words, the population was almost stationary.

The smallness of this increase was, of course, due to the famine, and is largely accounted for by the small number of children under 5 living in 1881, a result mainly of diminished birth-rates during 1878–9. To deduce from the observed rate of increase, 1871–1881, the rates prevailing during the prosperous period prior to 1871, and thence the average rate, the following method was employed: Assume that the rate previous to 1871 was r per annum, and that, but for the famine, this rate would have continued to 1881, then the number of children under 5 in 1881 would have been $749{,}836 \times (1+r)^{9\cdot26}$, in lieu of 578,306, actually counted. The difference between these numbers would be the extent to which the population had suffered from diminished birth-rate and increased infant mortality. In addition to this loss,

however, the population has suffered in respect of the increased mortality among the remainder (those over 5 in 1881). These, at the height of the famine, would have been aged 2 and upwards, consequently we have to enquire to what extent the death-rate for those ages was increased. Comparing the deaths registered in 1876–1879 with those of the two years preceding and following, we have the following figures.

TABLE 9.—*Madras (Selected Districts) Registered Deaths in Famine and Non-Famine Years.*

Period	Deaths Registered			
	Ages			
	0–1	1–6	6–12	Over 12
1876–1879 . . .	32,243	45,450	26,744	243,943
1874–5 and 1880–1 .	36,184	35,795	17,452	167,877
Ratio of Famine to Non-Famine Period	·89	1·27	1·53	1·45

The proportionate increase appears to have been the same for ages above 12. The deaths above 6 appear therefore to have been increased during the four famine years by 46·04 per-cent, those of age 1 and upwards by 42·95 per-cent, and interpolating between these two results it may be assumed that the death-rate above age 2 was in excess during the four famine years by 43·70 per-cent. It now remains to determine the normal death-rate for those aged 2 years and upwards. If we distribute the population under 5 in 1871, over the different ages 0 to 5 in the proportion corresponding to the Proclaimed Clans' population (Table 5) (but allowing for an annual rate of increase of 1 per mille) we find the number aged 2 and upwards in 1871 was 3,791,000, and the number entering their third year during the year were 150,200. The ratio of these two numbers is ·03962, and the difference between this fraction (which would be the birth-rate if dealing with age 0) and the annual rate of increase r will give the death-rate for ages 2 and upwards. More exactly this rate would equal $\cdot 03962 - \log_e \overline{1+r}$. Since for four years the population was subjected to a death-rate 43·7 per-cent heavier than this, the survivors in 1881 would be reduced in the proportion of $e^{-4\times\cdot 437(\cdot 03962-\log_e \overline{1+r})}:1$, and we should have the following equation for determining r:

$$(\text{Population over 5 in 1871}) \times (1+r)^{9\cdot 26}$$
$$= (\text{Population over 5 in 1881}) \times (1+r)^{1\cdot 75} e^{\cdot 0693}$$

Whence we obtain $r = \cdot 0118$; that is to say, the rate of increase prior to 1872 was about 12 per mille per annum, while for the $9\frac{1}{4}$ years preceding February 1881, it was, as already stated, rather under 1 per mille per annum. To estimate the average rate of increase for these provinces it is necessary to determine in what proportions these two rates should be combined. In 1854 Madras suffered from famine, which so far as these districts were concerned was probably as severe as that of 1878, and in 1856, at which time the first of the series of quinquennial enumerations was made, the state of things corresponded to that observed in 1881, while previous to 1854 there had been an interval of about 20 years of comparative prosperity similar to that preceding the recent famine. It appeared therefore that by taking the 25 years from 1856–1881, a fair average period would be obtained. An annual rate of increase of 12 per mille from 1856 and 1871 ($15\frac{1}{2}$ years) and of 1 per mille from 1871 to 1881 ($9\frac{1}{4}$ years) gives an average of about 8 per mille for the whole period.

In the Madras Presidency as a whole, it was thought unsafe to assume that the proportionate increase of registered deaths during the famine years represented the true increase, since it is very probable that in the crisis of the famine registration was much less complete than ordinarily. It was assumed, therefore, that the rate of increase in the province before 1871 was identical with that of the five selected districts, namely, 12 per mille, and this rate properly combined with the rate of decrease observed from 1871–1881 gave a mean rate from 1856–1881 of about 6 per mille. In arriving at this estimate, however, an allowance was made for the effect of emigration estimated at about 1 per mille per annum.

It will be unnecessary to refer in detail to the remaining provinces, in which the method used above was modified according to circumstances. In Bengal, for example, where the "Mortuary Returns" are of comparatively recent introduction and the registration extremely imperfect, the relative mortality of different years was tested by a comparison of the observed mortality among the gaol population. In this province, however, there was no question of famine to disturb the regularity of the rates, hence these returns sufficiently answered the purpose. The following table shows the recorded increase per annum of male population in the various provinces between 1871–2 and 1881, the assumed actual increase and the estimated average increase taking good and bad periods together.

TABLE 10.—*Rates of Increase (per mille per annum) of the Male Population of the undermentioned Provinces.*

Province	Recorded Rate, 1871/2—1881	Assumed Rate, 1871—1881	Assumed Average Rate
Madras (Selected Districts) .	$3\frac{1}{2}$	1	8
,, (Entire Province) .	-5	$-7\frac{1}{3}$	6
Bombay	$-\frac{1}{4}$	-3	8
Bengal	11	7	8
North-West Provinces . .	...	$\frac{1}{2}$	$3\frac{1}{4}$
Punjab (1855–1881) . .	8	...	6
Central Provinces . . .	24	...	8

Having determined, as satisfactorily as the data permitted, the mean rates of increase in the various provinces, it remained to adjust the Age tables, and in conjunction with the assumed rates, to reduce them to the ordinary l_x columns.

For the first 12 years of life the curves were drawn to correspond with the rates of mortality already deduced from the Proclaimed Clans' returns. These rates were, however, slightly modified in some of the provinces, it being assumed that they represented the mortality in non-famine periods. Thus in Madras, even in the selected districts, the rates were increased in such proportions as was indicated by the Mortuary Registers, the additional mortality of the famine period being spread over the 25 years 1856–1881. In Bombay, North-West Provinces, and Central Provinces, rates similar to the Madras Selected Districts were adopted, while in Bengal and the Punjab the Clans' mortality was adopted without modification.

The remaining portion of the tables was then adjusted by the graphic method—the curve being joined in smoothly at age 12 to that already obtained by means of the Clans' mortality, and drawn so as to follow as far as possible the actual figures. Any attempt to preserve the actual numbers in decennial groups would have produced only absurd results, and occasionally given negative rates of mortality.

A modification of the usual method of graphic adjustment was employed, which may be used with great advantage in the adjustment of Census Returns. A rough graduation of the figures by Mr. Makeham's formula being first made, the numbers living, as thus adjusted, were made the base line, and the deviations of the original figures from the formula were taken as the numbers for adjustment. Several distinct advantages were thus gained. In

the first place there was less chance of drawing the curve so as to give an anomalous progression in the resulting mortality; in the second place, the scale of the diagram was immensely increased (the deviations being of course small as compared with the actual numbers living); and finally, the difficulty in continuing the curve beyond 60 (above which age no trustworthy data was available as to the age distribution) was got rid of by making the curve gradually run into the base line; the effect being practically to distribute the numbers at the older ages in accordance with Mr. Makeham's formula. It may be remarked that in this respect very similar results would have been obtained by assuming that the rates of mortality at these ages in India are equal to English rates increased in a constant ratio.

Table 14 gives in quinquennial groups of ages the adjusted and unadjusted numbers, representing the age distribution in the various provinces. It must be borne in mind in comparing the adjusted with the original numbers that the former aim at representing the average age distribution, taking one period with another, and are therefore something more than an ordinary adjustment. For example, it has already been shown that in all probability the ages of lives past middle life were somewhat under-estimated in the enumerations, hence the actual numbers over 60 would, no doubt, exceed those shown by a mean between the 1871–81 figures, and this fact has been duly allowed for in the North-West Provinces, Bengal and Punjab Returns. In Madras and Bombay, however, while the same cause was existent, a further fact had to be considered, namely, the very abnormal character of the period immediately preceding the latter Census. In Madras the famine had been extremely severe, while in Bombay, although the famine mortality probably did not exceed that experienced by the North-West, yet it was much more exceptional in the former province, following a period of over 30 years' immunity. Hence on these grounds, greater weight should of course be attached to the 1871 figures as representing more nearly the normal state of things than those found in 1881. On reviewing this part of the investigation I should perhaps be inclined to alter somewhat the adjustment of the figures for the Central Provinces by making the numbers larger at the older ages, which would have given, with a similar rate of increase, a somewhat better value of life throughout. The rate of increase here, however, is so very doubtful that not much value could, in any case, be attached to the resulting tables.

Owing, however, to the small population of this district, its influence on the final results is very small.

In reference to the Female Tables, abundant evidence could be adduced to prove that in all the enumerations the females have been very imperfectly counted. Probably in Madras alone do the numbers returned correspond even approximately with the actual numbers. If this imperfection in the counting could be assumed to affect all ages alike, this would not, perhaps, be a serious obstacle to the use of the Census figures, but there can be little doubt that it is the ages from about 10 to 25 or 30 that are mainly affected, although this fact is obscured by the return of a considerable number of females as between these ages who are in reality older. The only safe plan seemed to be to assume that the Madras figures (which gave 505 females to each 1,000 of the population) were fairly complete and represented, approximately at least, the actual facts. Accordingly a table was formed from the Madras figures and made the basis of the remaining Female tables by assuming that the ratio of male to female mortality at the various periods of life was similar throughout India.

The principal difficulty with the Madras table was at the younger ages. It clearly would not do to employ here Proclaimed Clans' mortality, while as in the case of the males, the Census figures at the younger ages were too irregular to afford a suitable basis for calculation. A comparison was accordingly made of the ratios of the female to the male population, as found by a mean of the 1871-81 Madras figures, raising, however, the total females in 1871, to the proportion they held in 1881. The results of this comparison are given in the following table.

TABLE 11.—*Madras Province.—Females to* 10,000 *Males.*

Ages	In 1871 (corrected as above)	In 1881	Mean
0–10	10,073	10,349	10,211
10–20	10,471	10,131	10,301
20–30	10,425	9,901	10,163
30–40	9,873	9,767	9,820
40–50	9,724	9,930	9,827
50–60	10,427	10,961	10,694
60 and over	11,212	12,404	11,808
All Ages	10,234	10,234	10,234

The evidence of the Madras birth registration shows that at least 106 males are born to every 100 females, hence, as there are 102 females living under 10 to every 100 males, it is clear that the infant female mortality must be much the lighter, while since again we have an almost similar proportion of females between 10 and 20, it may be assumed that the rate of mortality midway between the two groups, that is, at age 10 and thereabouts, does not much differ in the two sexes. The progression of the remaining ratios shows that the female mortality must exceed the male until about age 40, where the ratio is stationary, while subsequent to that age it becomes less than the male mortality, probably for the remainder of life. The ratio of female to male mortality in the 1st year of life was estimated by comparing the two rates as given by the mortuary returns of 1880–81, the value of the probability of death in the year following birth being taken as ·2460 as against ·2875 for the male sex, a ratio of ·855. It was then assumed that the ratio at age 10 was unity, while above this age the female age table was adjusted in the same manner as the male. From the ratio between the two mortality rates at the various ages in the Madras Tables, the mortality tables for female lives in the remaining provinces were constructed.

Tables 14, 15, 16, and 17 contain a general summary of the results of the investigation. Table 14 gives the estimated birth and death-rates for the various provinces, which are extremely high, when compared with European rates. The highest birth-rates are found in the Central Provinces, Bombay and Madras, where in each case the rate reaches the enormous average of between 52 and 53 per 1,000, or nearly 50 per-cent higher than the English rate. It will be noticed that the highest death-rates and the lowest mean duration of life are also found in these divisions. The birth-rates are lowest in the Punjab and the North-West Provinces, but even here they reach 47 per 1,000. These rates are easily accounted for when the large proportion of married females at the child-bearing ages is considered. In England and Wales the married women under 45 were, in 1871, 11·3 per cent. of the total population; in India, in 1881, the married women between 12 and 38 (which may be taken as a corresponding period) formed 17·3 per-cent of the entire population; in other words, they were proportionately over 50 per-cent more numerous. Table 16 gives the expectation of life for decennial ages in each province, for males and females; and Table 17 gives the values for every 5th age of the numbers living, and the mortality per-

cent for India generally. A reference to the expectations in Table 16 will show that the Punjab and Bengal show the best results, while in respect to adult life the Central Provinces, North-West Provinces, and Bombay give the worst. While the difference between the various provinces are perhaps quite as great as would be anticipated, the general agreement is sufficiently marked to give some weight to the "combined" results.

It will be interesting to compare the figures for the combined provinces with the observations compiled by the late Dr. Haines, in respect of the mortality prevailing in the native army, active and retired. The details of these observations will be found in Mr. S. Brown's paper (*J.I.A.*, xvi, 214–5). Mr. Willis Browne, of the India Office, has, however, kindly supplied me with the figures of the mortality table (adjusted by Mr. Woolhouse's formula), based upon these observations, consisting of the returns of eight of the ten regiments referred to on p. 214, vol. xvi (the remaining two being excluded as having been subject to specially heavy mortality from Cholera epidemics), combined with the experience of the military pensioners given in p. 215 of the same paper. The expectations deduced from this adjusted table are given below, side by side with those I have obtained for the combined provinces, and with those deduced from Mr. Finlaison's uncovenanted service experience (*J.I.A.*, xviii, 153). The latter experience consists mainly of Europeans, but as the lives were, on the whole, exposed continuously to the effect of the climate, having, as Mr. Finlaison explained in this paper, practically no opportunities of recruiting in the hills, or of coming home on occasional leave, they were, in this respect, in the same position as natives.

TABLE 12.—*Expectations of Life, Males, as deduced from the Census Returns for the Combined Provinces, Native Military Experience, and Mr. Finlaison's Uncovenanted Service Experience* (1837-72).

Ages	Natives		Europeans	English Life Table, No. 3
	Census Returns	Military Experience	Uncovenanted Service	
20	28·6	30·6	...	39·5
30	23·8	25·3	25·8	32·8
40	18·9	19·4	19·5	26·1
50	13·9	14·4	13·8	19·5
60	9·3	10·3	9·1	13·5
70	5·4	6·8	5·7	8·5

These figures would seem to show that the effect of the climate upon Europeans and natives is not very different, when the extent to which they are exposed is the same. The similarity of the numbers in the first three columns is remarkable, the differences throughout being small as compared with the divergence from the English figures. Roughly speaking, they represent an addition of about 10 years to the age as compared with the latter. The slight inferiority of the value of native life as deduced from the Census figures was to be expected, when the class of lives dealt with is considered.

The question of European mortality in India does not, strictly speaking, come under the scope of this paper, but it may be worth while to show briefly how the native rates of mortality compare with the rates for Europeans deduced by various authorities, and for this purpose the following table is appended, in which are given the rates deduced by Mr. Finlaison and Mr. Brown, the mortality experience of the "Staff Corps", kindly supplied to me by the late Gen. Hannyngton, and the H^M rates.

TABLE 13.—*Comparison of Native and European Mortality in India.*

Ages	Rates of Mortality per-cent								
	Natives		Europeans						H^M
	(Census)		Uncovenanted Service (Finlaison)		S. Brown			Staff Corps Males	
	Males	Females	Males	Females	Military, Males	Civil, Males	Females		
20–24	1·91	2·20	...	1·86	2·43	1·68	1·58	1·33	·68
25–29	2·07	2·31	·94		2·64	1·67	1·38	·94	·69
30–34	2·26	2·41	1·40	1·91	2·78	1·74	1·26	1·40	·81
35–39	2·48	2·52	1·87		2·80	1·93	1·24	1·25	·95
40–44	2·81	2·67	2·23	2·04	2·81	2·07	1·23	1·71	1·07
45–49	3·28	2·93	3·12		2·82	2·10	1·25	1·30	1·37
50–54	4 03	3·43	4·15	1·77	2·87	2·28	1·37	1·70	1·75
55–59	4·80	4·44	4·51		3·01	2·74	1·69	2·25	2·40
60–64	6·72	6·25	7·69	4·04	3·55	3·37	2·16	...	3·46
65–69	9·90	9·15	9·26		4·96	4·33	2·95	...	4·99
70–74	14·20	13·50	12·61	...	7·00	6·19	4·21	...	7·49
75–79	21·00	20·50	...	...	10·02	10·31	6·48	...	11·47

There still remains much to be done in the way of investigating the effect of the climate upon Europeans, not only as to

the increase in the rates of mortality while in India, but more especially as to the effect of exposure for periods more or less prolonged, upon the chances of longevity after return to England. The difficulty of obtaining authentic materials bearing upon this latter point is very great. The Life Offices doing a large Indian business might be able to furnish trustworthy information on the subject, also the large Covenanted Indian Civil Service Funds, and the Records of the Indian Staff Corps; but it is doubtful whether any of these records could furnish all the information essential to a proper investigation of the subject. Probably all that can be said with any degree of certainty, is that: I. The effect of exposure, on acclimatized lives, appears to increase with its duration, and is by no means in the nature of a constant addition to the rate of mortality. II. That with an equal exposure, the ultimate effect of climate is practically the same upon both natives and Europeans. III. That the increased mortality no doubt continues for some years after return to England, and is possibly greatest at this period in consequence of the large numbers returning invalided. IV. That the lives surviving the period of exposure and the first few years following return, are quite equal to the average of assured lives.

TABLE 14.

Province	Birth-Rate			Death-Rate		
	Males	Females	Both Sexes	Males	Females	Both Sexes
Madras . . .	52·3	48·4	50·4	46·4	42·5	44·5
Bombay . . .	52·4	48 5	50·5	44·4	40·5	42·5
North-West Provinces	46·9	43·4	45·1	43·6	40·2	41·9
Bengal . . .	49·7	46·0	47·9	41·7	38·0	39·9
Punjab . . .	47·0	43·5	45·2	41·0	37·5	39·2
Central Provinces .	52·8	48·8	50·8	44·8	40·8	42·8

TABLE 15.—*Distribution by Age of* 10,000 *Persons in the undermentioned Provinces, showing the Adjustment of the Age Tables.*

MADRAS—MALES					MADRAS—FEMALES					PUNJAB—MALES			BENGAL—MALES		
Ages	Census 1871	Census 1881	Mean	Adjusted Numbers	Ages	Census 1871	Census 1881	Mean	Adjusted Numbers	Ages	Census 1881	Adjusted Numbers	Ages	Census 1881	Adjusted Numbers
0– 5	1,813	1,245	1,529	1,634	0– 5	1,873	1,284	1,579	1,621	0– 5	1,238	1,510	0– 5	1,430	1,591
5–10	1,493	1,381	1,437	1,293	5–10	1,405	1,354	1,379	1,313	5–10	1,394	1,227	5–10	1,555	1,279
10–15	923	1,318	1,120	1,166	10–15	755	1,131	943	1,184	10–15	1,218	1,120	10–15	1,139	1,157
15–20	1,057	874	966	1,042	15–20	1,218	797	1,008	1,048	15–20	888	1,017	15–20	757	1,035
20–25	840	818	829	913	20–25	904	973	938	906	20–25	847	909	20–25	711	911
25–30	943	826	885	793	25–30	1,012	873	943	777	25–30	848	805	25–30	882	797
30–35	535	892	714	683	30–35	460	928	694	662	30–35	846	705	30–35	860	693
35–40	732	592	662	583	35–40	724	489	606	562	35–40	506	611	35–40	630	598
40–45	335	650	492	492	40–45	280	661	470	475	40–45	645	523	40–45	633	508
45–50	502	330	416	408	45–50	523	291	407	399	45–50	340	440	45–50	353	423
50–55	180	416	298	330	50–55	152	475	314	331	50–55	486	361	50–55	409	341
55–60	335	169	252	257	55–60	368	152	260	266	55–60	165	285	55–60	163	264
Above 60	312	489	400	406	Above 60	326	592	459	456	Above 60	579	487	Above 60	478	403
Total	10,000	10,000	10,000	10,000	Total	10,000	10,000	10,000	10,000	Total	10,000	10,000	Total	10,000	10,000

BOMBAY—MALES					NORTH-WEST PROVINCES—MALES					CENTRAL PROVINCES—MALES				
Ages	Census 1872	Census 1881	Mean	Adjusted Numbers	Ages	Census 1872	Census 1881	Mean	Adjusted Numbers	Ages	Census 1872	Census 1881	Mean	Adjusted Numbers
0– 1	346	270	308	403	0– 5	1,614	1,213	1,414	1,510	0– 1	489	263	376	406
1– 6	1,736	1,311	1,523	1,546	5–10	1,322	1,338	1,330	1,234	1– 6	1,624	1,677	1,650	1,557
6–12	1,590	1,691	1,641	1,545	10–15	1,024	1,262	1,143	1,137	6–12	1,724	1,620	1,672	1,556
12–20	1,426	1,495	1,460	1,771	15–20	1,108	804	956	1,038	12–20	1,492	1,318	1,405	1,784
20–30	1,892	1,773	1,832	1,735	20–30	1,910	1,821	1,865	1,756	20–30	1,892	1,651	1,772	1,746
30–40	1,402	1,531	1,467	1,267	30–40	1,420	1,467	1,443	1,347	30–40	1,366	1,477	1,422	1,268
40–50	869	945	907	875	40–50	887	1,009	948	977	40–50	779	977	878	863
50–60	483	585	534	540	50–60	475	629	552	628	50–60	428	542	485	523
Above 60	256	399	328	318	Above 60	240	457	349	373	Above 60	206	475	340	297
Total	10,000	10,000	10,000	10,000	Total	10,000	10,000	10,000	10,000	Total	10,000	10,000	10,000	10,000

TABLE 16.—*Showing for every Tenth Year of Age the Mean Duration of Life in the principal Indian Provinces.*

Age	Madras		Bengal		Bombay		North-West Provinces		Punjab		Central Provinces		India (Combined Provinces)	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
0	22·35	24·18	24·50	26·51	23·04	24·89	23·10	24·94	24·80	26·85	22·80	24·65	23·67	25·58
10	32·92	32·39	35·04	34·48	32·87	32·26	32·97	32·35	35·57	35·05	32·46	31·84	34·00	33·42
20	27·86	27·77	29·56	29·47	27·38	27·20	27·38	27·18	29·92	29·88	26·92	26·72	28·55	28·44
30	23·59	24·24	24·62	25·34	22·71	23·27	22·63	23·13	24·96	25·77	22·20	22·69	23·80	24·48
40	19·06	20·20	19·43	20·60	18·01	19·00	17·46	18·73	20·05	21·35	17·55	18·50	18·90	20·03
50	14·28	15·37	14·25	15·33	13·17	14·10	12·91	13·75	15·07	16·28	12·85	13·75	13·93	14·96
60	9·60	10·17	9·42	9·97	8·66	9·15	8·36	8·81	10·25	10·90	8·43	8·90	9·25	9·79
70	5·66	5·88	5·49	5·69	5·01	5·19	4·78	4·94	6·19	6·43	4·85	5·03	5·44	5·63
80	2·92	2·96	2·86	2·90	2·51	2·55	2·41	2·38	3·32	3·37	2·42	2·46	2·87	2·88
90	1·00	·93	1·00	1·07	·50	·50	·50	·50	1·20	1·30	·50	·50	1·00	·91

TABLE 17.—*Native Life Table for India.*

MALES				FEMALES			
Age x	Living at Age x	Mortality per-cent	Mean after-lifetime at Age x	Age x	Living at Age x	Mortality per-cent	Mean after-lifetime at Age x
0	100,000	28·41	23·67	0	100,000	24·26	25·58
5	56,712	2·41	36·01	5	62,033	2·20	35·63
10	52,114	1·11	34·00	10	57,259	1·14	33·42
15	49,009	1·56	30·99	15	53,545	1·75	30·56
20	44,962	1·85	28·55	20	48,549	2·14	28·44
25	40,829	2·00	26·19	25	43,433	2·27	26·50
30	36,776	2·18	23·80	30	38,643	2·37	24·48
35	32,815	2·38	21·38	35	34,203	2·47	22·33
40	28,939	2·66	18·90	40	30,118	2·59	20·03
45	25,103	3·05	16·41	45	26,315	2·79	17·56
50	21,256	3·66	13·93	50	22,701	3·15	14·96
55	17,328	4·61	11·52	55	19,094	3·89	12·32
60	13,294	6·12	9·25	60	15,238	5·35	9·79
65	9,254	8·50	7·20	65	11,056	7·73	7·54
70	5,509	12·18	5·44	70	6,867	11·42	5·63
75	2,556	17·68	3·99	75	3,326	17·02	4·08
80	807	25·28	2·87	80	1,091	24·93	2·88
85	141	36·17	1·94	85	190	36·84	1·94
90	8	62·50	1·00	90	11	63·63	91

DISCUSSION.

The CHAIRMAN (Mr. M. N. Adler), in inviting discussion, pointed out that the paper was but an abstract of a very elaborate investigation which Mr. Hardy had made for the Census Commissioners of India, and which was given in detail in the Report of the Census for 1881.

Mr. A. J. FINLAISON said, that the mortality of Europeans in India was surrounded with considerable obscurity—much more so the mortality of the natives of India. The adjustments and corrections which had been found necessary illustrated the difficulty of obtaining the ages of natives in India with any degree of accuracy, which would be readily understood from the corresponding difficulty in obtaining the ages of uneducated persons in this country. When it is remembered that out of the enormous population of India, probably a very large proportion can neither read nor write, and are much less able to perform more than the most elementary operations of arithmetic, the difficulties of the enumerators when endeavouring to discover the ages of the people for a purpose with which, perhaps, they had not very great sympathy, became apparent. With regard to the mortality of infants at the ages immediately following birth, he could not help being struck with the very low rate indicated in the tables, even in those for the proclaimed clans where the history of children was presumed to be closely watched. A passage in Mr. Hardy's paper dealt with this point, namely, the reference to the enormous birth-rate that existed in proportion to the population. A high death-rate generally implies a high birth-rate,

and correspondingly in those instances where a high birth-rate was to be noticed, he should have been prepared to have seen a higher death-rate in the first year of infant life than was obtained by Mr. Hardy's deductions from the Census returns. With regard to the rate of mortality shown among the members of the Uncovenanted Service in the year of age immediately following birth, he was under the impression that in the paper which he had presented to the Institute (*J.I.A.*, xviii, 153), he had omitted that year of age from the illustrative summary tables. The reason for so doing was, that the children were voluntarily nominated for pensions by their parents. It was only reasonable to suppose that they would wait—as, in fact, they did—for some short time after the birth to nominate the child, and then they would only subscribe for a child who had a reasonable prospect of living. The mortality shown for the first year of life would thus be exceptional. The children of European parents born in India, in Mr. Brown's observations, would be similarly affected, for although those were the children of the Covenanted Civil Servants and of the officers in the Indian Army, and all children were entitled to the orphans' pension, yet the nomination would not be made in all instances immediately after birth. It was well known that the great mortality in infant children took place soon after birth, so that a large number of children who died soon after birth were never brought into the lists from which Mr. Brown deduced his death-rates. Such a state of affairs would, perhaps, account for the abnormal rate of mortality shown by Mr. Brown in the first year of life, namely, about one-half only of the mortality shown in the English Life Table. No doubt these children were of a superior rank of life to the whole body of the English population, but it was hard to believe that the children even of high-class European parents in India, where they were notoriously subject to severe mortality, would die in less numbers than children of the same age in England. [The Chairman—Do you think the mortality among these children of Europeans takes place so soon after birth?] Yes; he thought the heavy mortality among children did take place very soon after birth. He should be glad if Mr. Hardy could enlighten the meeting a little more with regard to the expressions showing the derivation of the corrections applied to the ages and rates of mortality.

Mr. G. H. Ryan thought that the questions of which Mr. Hardy had treated included many matters of extreme difficulty, and if he had had to deal with them in a broad and apparently arbitrary manner, he had, at least, explained the reasons that led him to adopt the courses he had followed, and had been careful to show that no point of difficulty had escaped his notice. He observed, that in his opening paragraph Mr. Hardy stated, that "the problem presented "and the methods employed belong distinctly to the work of the "actuary, although the results may, perhaps, have more interest for "the statistician." While the problem and methods were certainly of commanding interest to members of a scientific institution, still it seemed to him that it was the results which were arrived at by those methods that had the greater practical value. On these grounds, he thought it would have conduced to the greater practical value of the paper had there been included in it more statistical facts: for

example, the figures, in the rough, of the enumerated populations in the several districts and provinces, as also the enumerated deaths where possible. Then, further, had Mr. Hardy devoted a little space to explaining the processes and means by which the enumeration was completed, that would have enabled them to determine with what degree of trustworthiness they could treat the figures. The entire superstructure of Mr. Hardy's tables being based on the recorded results of the Census enumeration, it followed that, unless they knew exactly the processes adopted in obtaining those figures, they could not gauge correctly the measure of trustworthiness to be accorded to his results. Table 7, dealing with the effect of emigration and immigration, was rather a complicated problem to his mind. It was presented in such an abridged and neat form that it seemed by no means easy to understand; and he would suggest that a short explanation should be added to the table with the view of elucidating its purport. Passing on to Table 10, in which Mr. Hardy gave the rates of increase per mille per annum, of the male population in certain provinces of India, he would suggest the addition of another column showing the average annual rate of increase of the population in this country and foreign countries. That would enable them to see how the rate of increase in India compared with that of other countries. In regard to the several mortality tables he had deduced, Mr. Hardy had given the expectations of life, and also, for purposes of comparison, the expectations of life according to the English Table No. 3. As this was a point of so much practical importance in the business of life insurance, it would, perhaps, have been a valuable addition if he had given the expected deaths according to such tables as the Northampton and others reflecting a high rate of mortality, side by side with the actual deaths in his Indian tables. From this paper, it was seen that the rate of mortality was very high; but there were no means available of measuring the excess. At the end of his paper, Mr. Hardy says—"Probably all that can be said with any degree of certainty is "that—I. The effect of exposure, on acclimatized lives, appears to "increase with its duration, and is by no means in the nature of a "constant addition to the rate of mortality. II. That, with an "equal exposure, the ultimate effect of climate is practically the "same upon both natives and Europeans. III. That the increased "mortality no doubt continues for some years after return to England, "and is possibly greatest at this period in consequence of the large "number returned invalided. IV. That the lives surviving the "period of exposure and the first few years following return, are "quite equal to the average of assured lives." That last statement—No. IV—was of such importance that it would be advisable if Mr. Hardy would state whether it was the result of his general observations or whether he had any statistics to substantiate the matter. He considered that Mr. Hardy's paper added greatly to the knowledge of Indian mortality.

Mr. A. DAY enquired what "proclaimed clans" were, and how the mortality experience in these proclaimed clans became exceptionally valuable? He also asked, whether Table 1 (said to be a schedule "showing every age returned in an enumerator's schedule of 1,000 "persons in the north-west provinces") was an exceptional return, or

whether it was like all the rest of the returns made in the Census for 1881? Everybody seemed to be exactly of the age of 20, 25, 30, 35, and so forth, and the schedule looked somewhat unusual. The causes of excessive female mortality were not explained in the paper, but he supposed they were well understood. Mr. Hardy had prepared a mortality experience of the Barbados Mutual Office, and he was rather surprised he had not inserted a comparison of the death rates in the West Indies and East Indies.

Mr. H. W. Manly referred to Table 10, containing the rates of increase per mille per annum of the male population of certain provinces. There the assumed average rate did not appear to bear any resemblance whatever to the recorded rates in 1871–81; in fact, in the first two columns there were some figures showing an actual decrease in the numbers, while the final columns showed a steady increase throughout. Perhaps Mr. Hardy could explain in a few words the reasons of these differences; as they were not apparent on the face of the table. This paper had principally an interest for the meeting on account of the scientific methods adopted in deducing the rates; but there was also one very practical deduction that they could make, by reference to Table 12, where it was pointed out that the mortality in the Uncovenanted Service—that is to say, mortality among Europeans who were compelled to remain in India, and who underwent the continuous climatic effects of the continent—ran very close with the mortality among the native population. From this it appeared that a man who had become acclimatized had a worse chance of longevity than the man who started fresh with a vigorous constitution. He was already slightly impaired, and less able on account of his acclimatization to resist the effects of the climate. That was, he thought, a very practical deduction to be drawn from these observations. With regard to the method of graduation which Mr. Hardy had adopted, he noticed that he, like others who had had exceedingly difficult figures to manipulate, had adopted the graphic method, applying Mr. Makeham's graduation as a base line to assist him to draw the final line more evenly. In using the graphic method of graduation he had, himself, found great assistance by drawing a base line by means of Mr. Berridge's formula.

The Chairman (Mr. M. N. Adler) said that Mr. Hardy seemed to have confined himself more to the manipulation and the working out of figures which the Census authorities placed at his disposal, and had given no information with regard to the substructure of the actual facts, and the mode in which the Census was taken out in India. Too much reliance must not be placed upon many of these returns. In the introduction to the Report of the Census Commissioners it was stated, for instance, that in some places in India the enumeration created the utmost excitement amongst the population, so that even troops had to be brought down to quiet them. It was admitted, also, that in some of the districts the Census was a mere estimate, and was not an enumeration at all. Some people thought it was a ruse on the part of Government, or that it meant a forced recruitment to fight the Afghans, for the last Census took place immediately after the Afghan expedition. Others thought it was a means to increase the taxes: a capitation tax was spoken of.

Others, again, regarded it with superstitious awe, and the utmost reluctance was felt to giving any statistics. Certainly, it was extraordinary how, over such an enormous area, covered by 250 millions of human beings (or more than one-fifth of the population of the entire globe), information was obtained even in the way that it was—remembering, too, that in Central India many states are merely under British protection, and that there are tracts of country into which the British administration did not actually penetrate. Mr. Hardy had hardly dwelt sufficiently upon the difficulty of getting any reliable statistics of the number of unmarried females. Of the 250 millions about 190 millions were Hindoos, and it was a part of the tenets of Manu, which Hindoos observed, that marriages should take place at the earliest possible time. The result of this was, that in the present state of Indian society there was a surplus of children, and a consequent high rate of mortality amongst them. Then the inequality of age was a most important feature, as apart from the hypothesis propounded with regard to its influence on the sex of the offspring, it led to a diminution of the period during which the parents were both living, and brought about a superabundance of widows. But a further extraordinary result ensued. Such importance was attached by the Hindoos that all their girls should be married, that if their daughters were not married, having attained the age of twelve, or thirteen, they considered it a disgrace. There had been, therefore, the utmost difficulty in getting any statistics of girls not so married. The people actually concealed the fact that they had any females in the household who were unmarried. This fact was not known in the year 1871, when the enumeration took place. The consequence was that a most extraordinary disparity existed in the return between the two sexes at certain ages. In one district, it amounted to half-a-million, and that led to the presumption that there seemed to have been an infanticide of females. That was partly the reason why in certain districts there were what were called proclaimed clans. It was only prior to the last Census that the cause of the apparent disparity between the sexes seemed to have dawned on the authorities. They went very carefully into the matter, and it was then established that there were hundreds and thousands of cases where the existence of females at the stated age was concealed and ignored altogether. He could not see why the Madras Presidency should be particularly favoured as regards the accuracy or the reliance which could be placed on its returns. Mr. Hardy had taken four or five districts in the Madras Presidency with which to work out certain returns, which he afterwards adjusted. Then he applied these results to other presidencies and districts. He would like to know whether, seeing that famine existed in those districts, it was not likely that from some of them a certain flow of emigration took place to other districts which did not suffer or were less threatened by famine. The town of Madras itself was a port, and there the effect of famine would not be so much felt. Would there not be a natural influx of people during the famine to the port or district round about it, and would not that affect the accuracy of certain of the figures which Mr. Hardy used as the basis of his investigation? He would also refer to Table 13, in which appeared a comparison of native and European mortality in India. Mr. Hardy there made use of

certain highly interesting returns which the late General Hannyngton had placed in his hands. Most of the investigations as regards Europeans in India only referred to actual mortality experienced while they were in India. But when their health was impaired by the climate, what did they do? They did not remain in India to die there. They left India on sick leave, and if they did not die on the way home they died very shortly afterwards here in England. The Indian returns did not show the mortality of these impaired lives, and therefore they must look with a great amount of suspicion at the mortality of Europeans in India, without actually knowing what occurred to those lives when they left India. But with regard to General Hannyngton's Return, that referred to the mortality of the staff corps right through their career. After they left India due notice was kept of their doings; therefore, those returns were particularly interesting.

Mr. G. F. Hardy, in reply, said he was not surprised that various points had been suggested upon which fuller information would have been of interest, but the meeting would understand that it was a very difficult thing to condense explanations extending originally over a large number of pages into the short space afforded by a paper such as the present. Mr. Finlaison had desired a further explanation of the expression on page 227. This expression represented the estimated ratio by which the population, aged 2 and over, at the time of the famine, in the selected districts, was reduced by the four years of excessive death-rate in 1876–79; the index of e was consequently negative, the 4 representing the number of years to which the population was subject to extra death-rate, the ·437 the proportion by which the normal death-rate was increased during those four years, and the expression in the brackets, the estimated normal or pre-famine death-rates for age 2 and upwards. From this expression they would get the equation required for the purpose of determining r, the object being to discover from the rate of increase since 1871 what was the probable increase previous to that period. With respect to Mr. Finlaison's remarks on mortality in the first year of age as to his impression that it would be extremely heavy immediately after birth, that opinion was quite confirmed by the proclaimed clans' experience. The figures in their original form gave those dying in practically the first six months after birth. Thus they had a means of testing the mortality in the earlier part of the year succeeding birth, and they would find something like 23 per 100 dying in the first six months out of 28 during the entire year—by far the heaviest mortality being during the first half. In answer to Mr. Day, he explained that the proclaimed clans were those clans which were "proclaimed" under the Act of 1870 for the suppression of infanticide. It was suspected by the Government that female infanticide was practised in certain districts, and the suspected districts were by this Act subjected to a very strict system of registration under special police supervision. The ages in Table 1 illustrated the ignorance of Indian natives generally as to their exact ages. It must be understood, however, that they were not scheduled in exactly the same way as in this country, where each householder fills up his own schedule, but measures were taken better calculated among such a population to get at the exact facts. About three or four weeks

before the actual Census took place, a preliminary Census was taken all over India, not all on one day, but during a period extending over some time. No doubt the enumerators occasionally assisted the house-holders to estimate their own ages. On the night of the Census (February 18th, 1881), the enumerators went round to all the houses once more to correct the schedules down to date, and where there were any discrepancies they were investigated, and, if possible, put right. The table showing the birth-places of the Madras population was given for the purpose of supplying an answer to the question referred to by Mr. Adler—whether there would be any migration from districts where famine was severe to those districts less afflicted. That table seemed to show that there was no such migration to any appreciable extent. The Hindoos seemed to remain very much in the places where they are born, and although they might wander about in the neighbourhood locally during the famine, they did not seem to have left the districts in which they were living. Table 7 showed (taking the males only) that those living in the five districts, and born in the five districts, were four millions odd; those living in the five districts, and born in the remaining districts, were about 28,000. These, of course, would be those who had migrated from famine to non-famine districts. Those, on the other hand, living in the remaining districts, but born in the selected districts, had migrated for some reason or other from non-famine to famine districts to the number of 16,000; hence, there was a balance of about 12,000, which represented the net migration from famine to non-famine districts, a number quite insignificant. [The CHAIRMAN —Had any of the districts immunity from famine?] Not absolute, but comparative immunity. That was illustrated by a reference to Table 10, where the rates of increase were given. In the selected districts there was a recorded rate of increase of 3½ per mille per annum, but taking the whole of Madras (including these and the famine districts), there was actually a decrease of five per mille per annum, showing the severity of the famine in the remainder of Madras as compared with these particular districts. With regard to the three columns in Table 10, to which Mr. Manly referred, the "recorded rate" was obtained simply by a comparison of the two Censuses. The "assumed rate" was smaller by reason of the fact, that corrections had been applied to the earlier enumeration. The "assumed average rate" was the rate obtained, when the rate from 1871–81 was combined with the rates previous to 1871. For instance, in the case of Madras, the period taken was from 1856 to 1881; in Bombay, 1840 to 1881, simply because in either province these were estimated to represent average periods as to famines. An attempt was made in each case to get a period giving a fair average for the province dealt with. With respect to female enumeration, the points mentioned by Mr. Adler, were, of course, duly considered, and the conclusion come to was, that although the female enumeration was imperfect, still it had been rapidly improving. If they compared the proportion of females to males in the last Census with the proportion in the previous Censuses, it would be found to have gradually increased, and in Madras, where Censuses had been most frequent, the proportion was highest, namely, 505 females to every thousand of the population. They might infer that probably the actual omission of females there

in the enumeration was not very considerable, although, no doubt, many who were older than 12 were returned as of that age or younger. In Madras altogether they had had seven Censuses, and not only had the officials there had considerable experience in the matter, but the people themselves had become used to the enumeration, and probably there would not be the same difficulty in ascertaining the facts as there would be in the other provinces. In reference to Mr. Ryan's enquiry as to the grounds for assuming that the mortality of returned Anglo-Indians was eventually quite as light as that prevailing among English assured lives, he thought that was a mere statement of the facts as shown by Mr. Samuel Brown's tables, which he had quoted. It would be seen that, as regards both the military and civil experience, the mortality above age 60 was actually lighter than the H^M Table. It might be thought that, where the original data, especially the ages of the enumerated population, were so largely erroneous, it was useless to expect to draw any conclusions that could be relied upon. It should be remembered, however, that the errors which entered into the data were not purely arbitrary in their nature, but were no doubt subject to certain laws. These he had endeavoured to discover, and had so far succeeded as to be able to show, from the figures alone of the 1871 and 1881 Censuses, that at certain periods of life the tendency had been to under-estimate the ages, and at other periods the reverse. The question was not so much whether the data would yield exact results, as whether they could not be made to throw light upon the very interesting question of native Indian mortality, upon which, until the late Census was available, they had been almost entirely in the dark.

On the Graduation of Mortality Tables. By John Adams Higham, *Fellow of the Institute of Actuaries.*

It has been suggested that a formula given at page 17 of the present volume should be demonstrated, and its use in graduation more clearly explained.

A series of numbers increasing by third differences is summed continuously p at a time, the results are summed q at a time, these results again r at a time, and so on, until all is collected into one term, S.

To find S.

The first term of the first set entering into the first summation p at a time is u_0, or $(1+\Delta)^0$, or 1.

The last is $(1+\Delta)^{p-1}$.

S_p, the sum, is $\dfrac{(1+\Delta)^p-1}{\Delta}$.

This is also the first term of the first set entering into the second summation q at a time, the second term being

$$\frac{(1+\Delta)^{p+1}-1}{\Delta}-1,$$

and the last, or qth, $\dfrac{(1+\Delta)^{p+q-1}-1}{\Delta}-\dfrac{(1+\Delta)^{q-1}-1}{\Delta}$.

The result of the second summation is therefore

$$S_{p,q}=\frac{(1+\Delta)^{p+q}-(1+\Delta)^{p}}{\Delta^2}-\frac{(1+\Delta)^{q}-1}{\Delta^2},$$

which equals $\dfrac{(1+\Delta)^{p}-1}{\Delta}\cdot\dfrac{(1+\Delta)^{q}-1}{\Delta}$.

Proceeding in the same manner, we have, as the result of three summations,

$$S_{p,q,r}=\frac{(1+\Delta)^{p}-1}{\Delta}\cdot\frac{(1+\Delta)^{q}-1}{\Delta}\cdot\frac{(1+\Delta)^{r}-1}{\Delta};$$

in which the law of formation is manifest.

The result of the first summation S_p is

$$\frac{(1+\Delta)^{p}-1}{\Delta}=\frac{p.d_1+\dfrac{p.\overline{p-1}}{1.2}d_2+\dfrac{p.\overline{p-1}.\overline{p-2}}{1.2.3}d_3+\&c.}{d};\text{ that is,}$$

$$S_p=p\left\{1+\frac{p-1}{2}d_1+\frac{\overline{p-1}.\overline{p-2}}{2.3}d_2+\frac{\overline{p-1}.\overline{p-2}.\overline{p-3}}{2.3.4}d_3+\&c.\right\}.$$

Comparing this with the expansion:

$$p(1+\Delta)^{\frac{p-1}{2}}=p\left\{1+\frac{p-1}{2}d_1+\frac{\overline{p-1}.\overline{p-3}}{2.4}d_2+\frac{\overline{p-1}.\overline{p-3}.\overline{p-5}}{2.4.6}d_3+\&c.\right\},$$

and differencing the two expressions, we have

$$S_p=p\left\{(1+\Delta)^{\frac{p-1}{2}}+\frac{\overline{p-1}.\overline{p+1}}{2.3.4}d_2+\frac{\overline{p-1}.\overline{p+1}.\overline{p-3}}{2.4.6}d_3+\&c.\right\},$$

$$S_p=p\left\{(1+\Delta)^{\frac{p-1}{2}}+\frac{p^2-1}{2.3.4}d_2+\frac{\overline{p^2-1}.\overline{p-3}}{2.3.4.2}d_3+\&c.\right\}.$$

From the foregoing,

$$\frac{(1+\Delta)^{p}-1}{\Delta}=p\left\{1+\frac{p-1}{2}d_1+\frac{\overline{p-1}.\overline{p-2}}{2.3}d_2+\frac{\overline{p-1}.\overline{p-2}.\overline{p-3}}{2.3.4}d_3+\&c.\right\};$$

therefore,

$$\frac{(1+\Delta)^{q}-1}{\Delta}=q\left\{1+\frac{q-1}{2}d_1+\frac{\overline{q-1}.\overline{q-2}}{2.3}d_2+\frac{\overline{q-1}.\overline{q-2}.\overline{q-3}}{2.3.4}d_3+\&c.\right\}.$$

Multiplying and proceeding as before, we arrive at the result of two summations, being

$$\frac{(1+\Delta)^{p}-1}{\Delta}\cdot\frac{(1+\Delta)^{q}-1}{\Delta},$$

and find it equal to

$$S_{p,q}=p.q\left\{(1+\Delta)^{\frac{p+q-2}{2}}+\frac{p^2+q^2-2}{2.3.4}d_2+\frac{p^2+q^2-2}{2.3.4}\cdot\frac{p+q-4}{2}d_3+\&c.\right\}.$$

If M be written for $p \times q \times$ &c.,
" A " " $p+q+$ &c.,
" B " " p^2+q^2+ &c.,
" n " " the number of summations which have been made,

we obtain, by inspection of the two summations which have been worked out, the following general formula for any number of summations:

$$S_{p,q,r,\&c.} = M\left\{(1+\Delta)^{\frac{A-n}{2}} + \frac{B-n}{2.3.4}d_2 + \frac{B-n}{2.3.4}\cdot\frac{A-\overline{n+2}}{2}d_3 + \&c.\right\},$$

which is the formula printed in the previous paper, and there expanded as respects the power of $(1+\Delta)$.

To prove this formula for any number of past summations, let one more summation be made, t at a time.

The formula is to be multiplied by $\frac{(1+\Delta)^t-1}{\Delta}$, which is equal to

$$t\left\{(1+\Delta^{\frac{t-1}{2}}) + \frac{t^2-1}{2.3.4}d_2 + \frac{t^2-1}{2.3.4}\cdot\frac{t-3}{2}\cdot d_3 + \&c.\right\}.$$

The result, carried out to third differences only, is

$$M.t\left\{\begin{array}{l}(1+\Delta)^{\frac{A+t-(n+1)}{2}} + (1+\Delta)^{\frac{A-n}{2}}\cdot\frac{t^2-1}{2.3.4}d_2 + (1+\Delta)^{\frac{A-n}{2}}\cdot\frac{t^2-1}{2.3.4}\cdot\frac{t-3}{2}d_3 \\ \qquad + (1+\Delta)^{\frac{t-1}{2}}\cdot\frac{B-n}{2.3.4}d_2 + (1+\Delta)^{\frac{t-1}{2}}\cdot\frac{B-n}{2.3.4}\cdot\frac{A-\overline{n+2}}{2}d_3\end{array}\right\},$$

which, since $\quad (1+\Delta)^{\frac{A-n}{2}} = 1 + \frac{A-n}{2}d_1 + \&c.,$

and $\quad (1+\Delta)^{\frac{t-1}{2}} = 1 + \frac{t-1}{2}d_1 + \&c.,$

is equal to

$$M.t\left\{\begin{array}{l}(1+\Delta)^{\frac{A+t-(n+1)}{2}} + \frac{t^2-1}{2.3.4}d_2 + \frac{t^2-1}{2.3.4}\cdot\frac{t-3}{2}d_3 + \frac{t^2-1}{2.3.4}\cdot\frac{A-n}{2}d_3 \\ \qquad + \frac{B-n}{2.3.4}d_2 + \frac{B-n}{2.3.4}\cdot\frac{A-\overline{n+2}}{2}d_3 + \frac{B-n}{2.3.4}\cdot\frac{t-1}{2}d_3\end{array}\right\}$$

$$= M.t\left\{(1+\Delta)^{\frac{A+t-(n+1)}{2}} + \frac{B+t^2-(n+1)}{2.3.4}d_2 + \frac{B+t^2-(n+1)}{2.3.4}\cdot\frac{A+t-(n+3)}{2}d_3\right\},$$

an expression which resolves itself into, and proves, the general formula obtained by inspection as above.

The reason for stopping at third differences is that beyond that point the formula becomes complex; whereas up to that point it is very simple, by reason of the following law.

In a series of m terms increasing by third differences, the sum

of any two terms, equidistant from the middle term, is equal to twice the middle term, plus $\left\{\left(d_2+\frac{m-3}{2}d_3\right)\right.$ multiplied by the square of their distance from the middle term$\left.\right\}$.

Example.—Take the cubes of 1 . . . 9.

$$m=9;\quad d_2+\frac{m-3}{2}d_3=30.$$

Twice the middle term is $2\times5^3=250$.

$$250+(30\times1^2)=280=4^3+6^3$$
$$250+(30\times2^2)=370=3^3+7^3$$
$$250+(30\times3^2)=520=2^3+8^3$$
$$250+(30\times4^2)=730=1^3+9^3$$

In consequence of this law, any formula deriving a term from a combination, which includes equally the terms equidistant on either side, will, if correct to second differences, be correct to third differences also. In illustration: Mr. Woolhouse in calculating his formula, which fulfils these conditions, stopped at second differences (*J.I.A.*, xv, 392), yet the formula is correct to third differences, as shown in the *Journal* (Vol. xxiii, p. 350).

And thus, although the above general formula of summation contains three quantities, d_2, d_3, and the function of $(1+\Delta)$, which are unknown if the conditions and result of summation are alone given, yet two equations are sufficient to give the last unknown quantity, which is the only one we are concerned to determine; that is to say, the function of $(1+\Delta)$, or the middle term of the original series.

p terms of the original series enter into our working in the first summation.

$(q-1)$ more in the second.

$(r-1)$ more in the third, and so on.

Consequently, when we stop at a point where all the employed material has been collected into a single term, the number of terms of the original series (n being the number of summations) is $p+q+r+\&c.-(n-1)=A-\overline{n-1}$, which, for purposes of graduation, is to be taken as an odd number.

Therefore, the last term is U_{A-n}.

Therefore, $U_{\frac{A-n}{2}}$ is the middle term.

And $\frac{A-\overline{n+2}}{2}$ as a factor in the co-efficient of d_3 is a constant, and $\left\{d_2+\frac{A-\overline{n+2}}{2}d_3\right\}$ is a constant, although p, q, &c., be

varied in order to get a second equation for solution of the function of $(1+\Delta)$.

From the general formula of summation we obtain $(1+\Delta)^{\frac{A-n}{2}}$, or $U_{\frac{A-n}{2}}$, or the middle term of the original series, is equal to

$$\frac{S}{M} - \frac{B-n}{2.3.4}\left\{d_2 + \frac{A-\overline{n+2}}{2}d_3\right\}.$$

The use of this formula in graduation is, that by means of two applications it furnishes a value for any term derived from itself and from the neighbouring terms in proportion diminishing with distance, and employing in this way any number of the neighbouring terms which may be thought sufficient for smoothing down irregularities apparent in a series, assumed in the main to be in orderly progression. The paper already referred to, page 22, suggests, as the most convenient application of the method, that the series be continuously summed five terms at a time, four times, and the result called S. Also, that the results of the third summation be summed four at a time, and these results two at a time, the outcome being called Σ. And it is shown that the middle term of the original series will be

$$\frac{2\Sigma - 3S}{125}.$$

To show that so much of the series, as is in orderly progression, will, as far as third differences, be reproduced without alteration, take a series in which u_0, d_1, d_2, and d_3 are each $=1$.

Series	First Fives	Second Fives	Third Fives	Fourth Fives $=S$	3S	Third Fives in Fours	Two $=\Sigma$	2Σ	$2\Sigma - 3S$	Same $\div 125$ or $\times \cdot 008$
1										
2										
4	30									
8	55									
15	95	575								
26	155	900								
42	240	1,350	7,500							
64	355	1,950	10,625							
93	505	2,725	14,625	78,125	234,375	52,375 70,625	123,000	246,000	11,625	93
130	695	3,700	19,625							
176	930	4,900	25,750							
232	1,215	6,350								
299	1,555	8,075								
378	1,955									
470	2,420									
576										
697										

In practical working three columns may be saved (*see* page 23); thus:

Third Fives	Three Middle Terms	Two Outside Terms	Difference being $2\Sigma - 3S$
7,500 10,625 14,625 19,625 25,750	44,875	33,250	11,625 as before

The middle term is reproduced. If it be thought that a great many figures are employed to obtain a single result, it should be observed that very few are proper to that result, the rest being available for graduation of preceding and succeeding terms.

It remains to note the effect of the formula on the irregularities in the series considered apart from the orderly portion, and for this purpose the formula is to be thrown into another shape.

Term	Number of Entries					Proportion
	into Σ	into 2Σ	into S	into $3S$	into $2\Sigma - 3S$	
u_0	1	2	1	3	− 1	−·008
u_1	5	10	4	12	− 2	−·016
u_2	14	28	10	30	− 2	−·016
u_3	30	60	20	60	...	...
u_4	54	108	35	105	3	·024
u_5	83	166	52	156	10	·080
u_6	111	222	68	204	18	·144
u_7	132	264	80	240	24	·192
u_8	140	280	85	255	25	·200
u_9	132	264	80	240	24	·192
u_{10}	111	222	68	204	18	·144
u_{11}	83	166	52	156	10	·080
u_{12}	54	108	35	105	3	·024
u_{13}	30	60	20	60	...	...
u_{14}	14	28	10	30	− 2	−·016
u_{15}	5	10	4	12	− 2	−·016
u_{16}	1	2	1	3	− 1	−·008
...	1,000	2,000	625	1875	125	1·000

Whence $u_8 = \cdot 200 u_8 + \cdot 192(u_7 + u_9) + \cdot 144\{u_6 + u_{10}\} + \&c.$

Suppose now that an irregularity amounting to unity appears in u_8 of the example, stating it at 94 instead of 93. The graduation assigns ·200 to u_8, amending it to 93·2. It assigns ·192 to the preceding term and the same to the succeeding term;

also ·144 to each term next on either side; and so on, as the work is continued above and below in graduating the lengthened series of which the quoted terms are to be regarded as forming a portion. A stumbling-block in the road is reduced to one-fifth of its height, and the shifted material is spread in a curve on either side.

Report of the Medical Director (Dr. Thomas A. Foster) *of the "Union Mutual Life Insurance Company", Portland, Maine, upon the Death Losses for the eight years ending* 31 *December* 1884.

We have received from Mr. J. E. De Witt, the President of the *Union Mutual Life Insurance Company*, of Maine, a copy of the small pamphlet of 22 pages in which Dr. Foster states the results of his examination of the death losses of the company for the last eight years. The total number of deaths was 1,300, of which 208 were due to consumption, 147 to other diseases of the lungs (including 98 from pneumonia), 155 to heart disease, 135 to diseases of the brain, and 103 to diseases of the kidneys (including 73 from Bright's disease). Dr. Foster is of opinion that the mortality from consumption, 208 deaths, being only 16 per-cent of the whole, is a "remarkably good showing", being one per-cent better than that of the *Mutual Life Office* of New York from 1843 to 1874, and 11 per-cent better than that of the *United States Life Office* during the first 23 years of its existence. Adding "other diseases of the lungs", we get a total of 355, which is 27 per-cent of the total deaths; and Dr. Foster infers that it is safe to say that at least one-fourth of all insured persons die from some form of lung trouble. He adds: "While we may "properly enough question the hereditary nature of consumption "itself, none, I think, will doubt but that a tendency to, or a "condition of system favorable to its development, is often "inherited; and this, in connection with its probable contagious "character, makes it the one particular disease insurance com-"panies have most reason to guard against. 'Tis true its "incurable nature is not so universally believed in at present, as "in times past; still so remarkably fatal is it, that, for all "practical purposes, it might as well be considered both incurable "and hereditary. It is so often preceded by some form of "scrofula, catarrh, or 'blood spitting', that when any of these "troubles are present at time of application, even though there

"seems to be no direct heredity, great pains should be taken to "make sure that the seeds of consumption are not already taking "root in the applicant." "Of those who died of consumption, "19 had been troubled with some form of lung disease before "insurance; 10 had had pneumonia, 1 twice; 2 had suffered "from pleurisy, 2 from bronchitis, and 5 had spit blood. 13 of "them showed an hereditary taint to the disease by family "history. In all, 67 of those dying of consumption were in "some way predisposed to it, *i.e.*, 32 per-cent. But a much "larger number, namely 225, were predisposed to this disease, "most of whom died from other troubles. This may be studied "from two standpoints. If viewed in one way, it might lead to "the opinion that, when so small a part of all predisposed to it "died of consumption, this matter of heredity must be of less "importance than insurance companies are now giving it; while, "if viewed in what is undoubtedly its right light, it tells us that "its naturally debilitating tendency, not only predisposes to death "by consumption, but also to premature death from other "diseases. At any rate we see no reason, on account of our "comparatively favorable consumptive record, to in the least "change our rules relating to this class of risks."

Next in frequency to lung diseases come diseases of the heart. These caused 155 deaths, or 12 per-cent of the whole. Dr. Foster remarks: "As heart disease is so intimately connected with "rheumatism and kidney disease, it becomes very necessary to "enquire carefully into the condition of all applicants who show "a tendency to these troubles." "There can be no doubt", he says, "but that many of the cases here reported as dying of heart "disease really had been suffering for a long time from fatty "kidney, and most likely actually died of Bright's disease." He is further of opinion that "urinalysis is often a great aid in the "diagnosis of these troublesome forms of heart disease", (weak, fatty, and strained hearts); and he sums up this branch of his subject by saying, "With our present knowledge and experience, "I should be about as willing to omit an examination of the "heart as this test of the condition of the kidneys."

With regard to the 135 deaths from disease of the brain, or 10½ per-cent of the whole, Dr. Foster remarks, "No doubt quite "a number of these died from uræmia, as a direct result of "Bright's disease."

From the extracts we have given it will be seen that Dr. Foster attaches very great importance indeed to an examination of the

urine. He recurs to the subject in speaking of the diseases of the kidneys, which caused 103 deaths (or 8 per-cent of the whole): "85 of the 103 died of chronic disease, probably of several years' "standing, that could only be positively diagnosed by testing the "urine. We also find 15 cases of death from bladder disease, "which were undoubtedly, most or all of them, of long standing, "and of a nature that a careful urinalysis would have easily and "surely detected a long time before death;—in some, at least, at "the time insurance was obtained." "The fact that so large a "number of the cases of Bright's disease, died so soon after being "insured, taken in connection with the chronic nature of the "disease, shows plainly the importance of a more general ex-"amination of the urine. Probably three-quarters of the cases "reported as dying from kidney disease within five years after "being insured, would have been rejected had urinalysis been "made at time of application."

Dr. Foster gives an interesting table showing in 1,121 of the cases the average weight of the persons of each given height; and he compares these with the American standard weight, in the first four columns of the following table:

Relation of Height to Weight.

Dr. Foster's Observations			American Standard Weight	Medium Weight according to some other Tables		
Height	No. of Cases involved	Average Weight		Hutchinson	Brent	Macaulay
		lbs.	lbs.	lbs.	lbs.	lbs.
4 ft. 9 in.	1	76	95	...	...	...
4 ft. 10 in.	1	142	100	...	...	...
5 ft. . .	11	124	115	...	...	...
5 ft. 1 in.	14	123	120	120	...	125
5 ft. 2 in.	32	138	125	126	...	128
5 ft. 3 in.	33	140	130	133	125	131
5 ft. 4 in.	66	137	135	139	131	134
5 ft. 5 in.	75	143	140	142	137	137½
5 ft. 6 in.	119	147	143	145	144	141
5 ft. 7 in.	121	151	145	148	150	145½
5 ft. 8 in.	192	153	148	155	157	151
5 ft. 9 in.	136	157	155	162	164	156½
5 ft. 10 in.	162	166	160	169	172	161½
5 ft. 11 in.	76	175	165	174	179	167
6 ft. . .	55	177	170	178	187	173
6 ft. 1 in.	17	190	175	...	195	...
6 ft. 2 in.	7	176	180	...	203	...
6 ft. 3 in.	2	160	185	...	211	...
6 ft. 4 in.	1	186	190	...	219	...
						...
Average 5 ft. 8 in.	1,121	155				

It will be noticed that, with the exception of the one case who was 4 ft. 9 in., and was a boy when insured, and the 10 who were 6 ft. 2 in. and upwards, the average weight is in excess of the American standard. We do not know on what statistics this "Standard" is based; but whatever weight it may be entitled to as a whole, there are irregularities in it which, in our opinion, must detract greatly from its value. As a general rule, it makes the weight increase 5 lbs. for each additional inch in height; but the increase in weight from 4 ft. 10 in. to 5 ft. is at a larger rate, namely 15 lbs. for the two inches. From 5 ft. 5 in. to 5 ft. 6 in. the increase is at a lower rate, namely only 3 lbs.; while for successive additions of one inch to the height after 5 ft. 6 in. the additions to the weight are 2, 3, and 7 respectively. We cannot believe that these irregularities are justified by the facts, or correspond to anything in nature. The subject of the relation of weight to height is treated in this *Journal* (xxiii, 62); and, for the purpose of easy comparison, we have extracted certain figures there given (or referred to), and have placed them alongside Dr. Foster's in the last three columns of the above table.

Dr. Foster appears to consider that a departure of 20 per-cent in either direction from the average weight is permissible; and those who exceed the average weight by more than 20 per-cent he calls "Overweights". It appears from a table which he has prepared that, of the 208 persons who died of consumption, the heights and weights of 200 were known; that only 3 of these were overweights, and only 7 underweights; in other words, that 95 per-cent of the whole must be considered to have been of normal weight. Of 155 who died of heart disease, the weights of 25 were unknown; and of the remaining 130, 33 (or 25 per-cent) were overweights. Similarly, the overweights in the case of kidney disease, were 25 out of 92 (or 27 per-cent); in apoplexy, 15 out of 58 (or 26 per-cent.) "There were no underweights in "all the cases dying from heart, brain, or kidney disease."

Dr. Foster's Table, No. 5, seems to be of sufficient interest to be reproduced here entire. It shows, "in tabular form, the causes "of death in those predisposed to other forms of disease."

Diseases Causing Death	Aneurism	Apoplexy	Bowel Complaint	Brain Disease	Bladder Diseases	Casualties	Cancer	Consumption	Diarrhœa	Dysentery	Erysipelas	Diphtheria	Gangrene	Fevers	Heart Diseases	Kidney Diseases	Lung Disease (acute)	Old Age	Peritonitis	Paralysis	Rheumatism	Spinal Diseases	Stomach & Liver Diseases	Small-pox	Totals	Internal Hemorrhage
Applicant having had Rheumatism	1	6	1	6	2	2	4	11	2	...	..	..	1	3	20	8	10	..	1	7	6	1	7	...	99	...
Applicant having spit Blood	...	1	...	...	...	...	..	5	...	...	..	...	...	...	3	2	2	..	...	1	...	...	1	...	15	...
Applicant having had some form of Heart Disease	...	2	...	1	...	1	2	1	...	...	...	...	...	.	2	5	1	...	...	1	...	...	1	...	17	...
Applicant showing a direct inheritance to Consumption	...	12	9	18	6	8	10	67	...	3	2	2	1	9	26	19	33	4	1	7	...	2	5	1	†255	...
Applicant showing a direct heredity to Cancers	...	3	1	5	1	2	2	2	...	...	1	..	1	1	3	3	7	...	...	2	1	...	2	...	†39	...
Applicant showing a direct heredity to Heart Disease	...	3	...	...	...	...	...	3	...	...	...	...	...	1	5	3	5	...	1	3	1	...	...	...	25	...
Applicant showing a direct heredity to Apoplexy	...	2	...	...	...	1	3	8	...	...	..	...	...	...	6	2	9	..	1	4	1	...	1	1	39	...
Applicant showing a direct heredity to Kidney Disease	...	1	1	...	2	...	...	1	...	...	...	...	...	...	1	...	1	...	...	1	...	...	...	...	8	...
TOTAL	1	30	12	30	11	14	21	98	2	3	3	2	3	14	66	42	68	4	4	26	9	3	17	2	...	...
Overweights	*1	15	1	4	1	2	6	3	1	1	2	...	...	5	33	25	18	1	2	5	1	...	9	...	139	3
Underweights	...	...	..	1	...	...	2	7	...	1	...	...	...	...	1	...	2	...	...	...	...	...	...	...	15	1

* Abscess.

† These figures are correctly taken from Dr. Foster's Table; but there is an error somewhere, as the totals of the preceding columns are 245 and 37.

He remarks upon it that, of the 99 who had had rheumatism at the time of application for insurance, 20 died of heart disease, and 10 of lung disease, making, with those who died of disease of kidneys, apoplexy, brain disease, rheumatism, paralysis, and consumption, 53, "or more than one-half dying of troubles directly "connected with the rheumatic diathesis." His conclusion is: "Now, when we consider the large proportion, 99 out of 1,300, "who had manifested this diathesis, by having had rheumatism "more or less severely, it seems to me we must in the future be a "little more careful in writing on risks of this kind."

It will be noticed that the report gives us no information as to

the total number of lives (or years of life) under observation; but a most interesting table is given, arranging 1,280 of the deaths according to the year after insurance in which death occurred.

	1 Year	2 Years	3 Years	4 Years	Over 4 Years	Total Cases
Whole number of Cases . .	100	87	83	98	912	1,280
Those predisposed to Cancer .	4	4	3	2	26	39
Those predisposed to Consumption	10	10	10	11	214	255
Those predisposed to Heart Disease	1	4	0	6	4	15
Having had Rheumatism . .	11	8	4	5	71	99
Those having had Acute Lung trouble	1	2	3	4	5	15

We think it probable that various interesting conclusions might be drawn from this table; but we will content ourselves on the present occasion with remarking that the number of deaths which occurred in the first year after insurance, namely 100, against 87, 83, and 98, in subsequent years, appears to be a very large number. The deaths which occurred in the years 0, 1, 2, 3, after insurance, according to the experience collected by the *Institute of Actuaries,* were as follows:

Class of Lives	Years Elapst since Date of Insurance			
	0	1	2	3
H^M Healthy Males	295	897	1,032	1,077
H^F ,, Females	53	176	191	180
D^{MF} Diseased Lives	67	168	164	157
TOTAL	415	1,241	1,387	1,414

It must be borne in mind that the year "0" of insurance comprises only six months, and that the rate of mortality in those six months is much less than in the following six months; so that, for the purpose of comparison with Dr. Foster's figures, the number of deaths in "year 0" must be more than doubled. When the fullest allowance, however, has been made on this account, the number of deaths in the year immediately after the grant of the policy, will be considerably less than those in each of the two following years, instead of considerably more, as in the *Union Mutual* figures. In other words, the first year's mortality

in the American company appears to have been excessive as compared with that of the two subsequent years,—a circumstance which seems to point to the possibility that there may have been a considerable number of fraudulent claims among the 100 which arose in the first year.

T. B. S.

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A.

(*Continued from* p. 133.)

The second life assurance project in 1710 to be noticed is the following.

2. This day (16th December 1710) are published from the Office, at the Wheat Sheaf, over against Tom's Coffee-House in Russell Street, Covent Garden, proposals for the benefit of the Clergy and Widows of Clergymen, by a Joint Contribution, whereby a Clergyman by a Contribution of 10*s.* (as in the proposals is at large expressed) may be entitled to the sum of £750 on his being instituted and inducted into a Rectory or Vicarage in England or Ireland, or sent as a Missionary by the Corporation of the Society for Propagating the Gospel in Foreign parts; or by a Contribution of 5*s.* may be entitled to the sum of £375, or by a Contribution of 2*s.* 6*d.* to the sum of £187. 10*s.*, in the cases aforesaid, with other advantages for the Widows and Children of the Contributors.

A clergy mutual assurance society has been founded in England during the present century, and a life assurance bank in Germany, but each on a much more substantial basis than was here contemplated.

First Work on Life Assurance.

During this same year, which had produced two such undeveloped schemes, there was published in London, by John Ward, of Chester, a little book, written in a popular style: *Clavis Usuree; or a Key to Interest, both simple and compound: containing practical rules, plainly expressed in words at length, whereby all the various cases of interest and annuities, or leases, either in Possession or Reversion and Purchasing Freehold Estates, may very easily be resolved, both by Pen and a small Table of Logarithms hereunto annexed. For all rates of Interest, and Times of Payment whatsoever; Illustrated by variety of Examples. To which is added Rules to be observed in Estimating the value of Annuities, or Leases, and Insurance for Lives, &c., &c.* This

book deserves special mention here, because it is the first which treats of life assurance as such. At page 110, after familiarizing the reader with the results of Halley's Table, the author remarks: "By what has been said, the *Price of Insurance upon Lives* "*ought to be regulated,* and the difference discovered between the "price of insuring the life of a man of twenty and one of fifty "years old"; a piece of knowledge which should have been of consequence just then.

The year 1711 is an important one in Life Assurance History: for then was enacted the first Act of Parliament specifically bearing upon Insurance Associations. The early projects of the year were:

1. "Notice is hereby given from the *Original Office for* "*Insuring Officers and Seamen sums of money on their being lost* "*or taken, and relieving their Widows and Orphans,* at the "Golden Key in East Smithfield, a Linen Drapers, near Tower "Hill. That there is actually and firmly settled 100 acres of land "of the Proposer's own real Estate, as security for performance of "what by him proposed, the value of which is £1,000; and better "and further security if required. The Conveyances of the Lands "are to be seen at this office aforesaid, to be kept at the hands of "12 Trustees chosen from amongst the Contributors."

2. "For the Encouragement of Navigation for Masters, Mates, and other Sea-faring men that are burnt, sunk or Taken." This office was opened by Henry Wilson, Gent., in Jacob Street, Southwark.

3. "At the Insurance Office, the Great new House in Knowles "Court (the sign of the Crown being at the Gate) in Little Carter "Lane, near the East End of St. Paul's Church, this day subscrip-"tions are taken in at a certain charge upon *Births* at 6 and 8 "weeks, on payment of 12*s.* or 6*s.* or 4*s.* per week, or 2*s.* weekly "to divide if full, £3,600; and also upon *Marriages,* by payment "of Claims at 26 weeks; and also upon *Births* at 36 weeks. And "upon Shrove Tuesday next will be taken in Subscriptions upon "*Servants* at a certain charge, upon quarterly payments of 3*s.*, 6*s.*, "or 12*s.* Any person entering 6 shall have a 7th gratis. Pro-"posals delivered at the office." This was a new departure which soon assumed considerable proportions, and which I shall not follow up here; except where Life Assurance was carried on at the same office.

4. *The Nonsuch and most Advantageous Society on Marriage,* at the Blue Bell, without Newgate; Director, Augustine Woollaston.

"And at the same Office is two Societies on the Lives of men, women and children, and upon a good foundation."

5. "Notice is hereby given that a Mutual Contribution "is established and carried on at the office in Ironmonger Lane, "for securing against Losses happening by death, which does "effectually do the business of Insurance, and that upon such "easy terms that not the least trouble is given to the Insurer, or "to the person whose Life is insured; but each party choosing "what degree of charge he thinks fit, payable only once a quarter, "nominates any persons whatsoever (whether sick or in health) "under 60 years of age, and receives his share of the Contri-"butions on the death of the party Insured on: provided such "party lives six months from the time of nomination." This was a fitting climax to what had preceded this invitation to nominate sick persons, provided they could only be kept alive six months.

Earliest Insurance Legislation.

In March 1711 (new style) there was enacted the 9th Anne, Chapter 6, for the purpose, *inter alia*, of "Suppressing such unlawful Lotteries and such Insurance as are therein mentioned."

In section 57 it was recited: "And whereas several ill disposed "persons with design to defraud Her Majesty's subjects have of "late presumed to erect and set up offices and places for making "Insurances on Marriages, Births, Christenings or Service; which "practices are also prejudicial to the public, and tend to defraud "Her Majesty's subjects." It was therefore declared that every person or persons who after 8 March 1711 "shall erect or set "up an office or place for making Assurances on Marriages, "Births, Christenings, or Service, shall forfeit for every offence "£500." And every person who had before that date erected and set up Insurance Offices for such purposes, "should make or "suffer to be made therein any new Insurances, or contracts for "new Insurances on Marriages, Births, Christenings and Service, "or on any of them, shall forfeit for every such offence the sum "of £100." The Offices previously erected were to be continued for making good their former Insurances only.

It is seen that this Act did not mention the Life Offices. It is not easy to divine why. Perhaps the business was looked upon as more legitimate, in consequence of the Charter which had been granted by the Queen to the *Amicable*. We may now resume our enumeration of the Life Assurance projects of this year.

6. "In regard, the Act of Parliament did not intend wholly

" to exclude the Benefits that were reaped by many Offices in "Town, tho' others were not regularly carried on; *and not excepting* "*of it the offices upon Death.* This is to give notice that there is "a new and advantageous method settled upon Lives, and safety "of women in *Child-bed,* to the great benefit of their families, "next door to Pools' Coffee-house, without Bishopsgate; where "proposals may be seen, and the money returned at the months "end if satisfaction is not given."—*Vide* Advertisement in *Postboy,* 5 April 1711.

7. On the 30th March was advertised a scheme of "Assurance in Lives by Claims, and also by monthly and quarterly dividends," said to have been founded on 1st March at the Mitre in St. James' Market. The Treasurer had given £3,000 and security. The "Assurance of Life by Claims" seems to mean payment of specific sums on death.

8. "Annual proposals to Parents for the Provision of themselves and their Children, &c.," at Bournes Coffee-house in Finch Lane, Cornhill. "Calculated for the Ease and Benefit of all persons concerned therein; being founded on such a basis as cannot fail of procuring their increase and render them lasting and beneficial."

9. "From the several offices of Insurance at the Carved Porter "in King Street, Guildhall, and at the Sword Cutters, the corner "of St. Paul's Church Yard, near Cheapside Conduit, where will "this day be opened Books of Subscription for three Societies on "Lives, for £1,000, £500, and £250, or in proportion to the "number of subscribers."

"NOTE.—All who enter the first week are to make two "payments, *and that all Subscribers, on Marriages, Births,* "*and Services, in either of these offices who have not made any* "*claims may enter into these Societies,* paying, &c.—*Post Boy,* "April 10."

10. "The *London Charitable Society* is removed to the Crown, "Paternoster Row, where Subscriptions are taken daily upon Lives "of men, women and children, paying an Entrance for Policy "Stamps but 1*s*."

11. *Grand Contribution Office,* Crone Court, Fleet Street. "The Books of the said office are opened and Subscriptions taken "on the Lives of apprentices, children, &c. Abstracts of the "Articles of Settlement may be had at the office gratis."

12. *Mutual Contribution Office* "for securing against Losses happening by the death of Friends or others," Ironmonger Lane.

There can be no doubt that several of these offices had been projected previous to the passing of the Act, as offices for marriages, &c. After it, they took up the business of Life Assurance.

The year 1712 opened with a new combination of Lottery–Life Assurance projects, of which mention of a few of the chief will be sufficient.

1. *Equitable Society:* "A sure provision for posterity founded upon the Exchequer." A Subscription of 2,000 lives was to be taken and no more, of any age or sex, which might be on their own lives for the benefit of their children, relations, executors, administrators or assigns, or on the lives of any other persons, for the benefit of themselves, without their knowledge. The Subscribers were each to pay £10, in four fortnightly instalments, by means of which £20,000 was to be raised, which should be "laid out as "fast as it came in, in blank and benefit-pay Lottery Tickets, "which at something under 9½ years' purchase (the price they "are now to be bought at) will lay about £2,200 per annum for "the residue of 32 years, reckoning 31 years to come; and if they "should be to be bought still more under 9½ years' purchase, the "£20,000 will buy more than £2,200 per annum." These proceeds to be divided quarterly amongst the death claims. An elaborate scheme was drawn up to work out the details.

2. In April, there was announced from the Blue Ball, near Newgate, the *United and most Beneficial Society for a Perpetual Assurance on the Lives of Men, Women, and Children.* "The "great extremity to which Widows and Orphans are reduced by "the death of the persons on whose lives their maintenance did "depend, shows the merit of some settled provision to be made "for the preventing such misfortunes, which is the full intent "and design of this Company's undertaking." Mr. Augustine Woollaston was the moving spirit here, and it was intended to apply for a Charter of Incorporation.

3. On the 21st July were issued: "Articles for the Establish- "ment of a Company intended to be Incorporated by the name "of the *Most Advantageous Insurers*, upon the Lives of Men, "Women, and Children, for the benefit of themselves and "posterity for ever; and for the advancing the Credit of Lottery "Tickets in the year 1712." Here again an elaborate scheme was prepared. The Subscribers were to make a contribution of £100 to the funds, viz., £20 the first year, and £10 in each of the succeeding eight years. The proceeds of the invested funds were to be divided annually on a graduated scale amongst the

Subscribers on the death of their nominees, viz., £1,500 in the year 1714, increasing up to £16,000 in the sixteenth year—1729. Hence a Tontine was established from the accumulating funds in favour of the longer survivors. The ultimate ending of the scheme is by no means clear, and it probably never became matured. The following appears to relate to the same undertaking:

"This day is published *a short account of some approved method already settled to make provision for posterity; with an essay towards establishing a Company for that purpose more advantageous than any before invented. The members of which by contributing small sums of money for a few years only, will secure a good Estate to themselves and their families for ever.* The said account, etc., to be had gratis at Mr. D. Brownes, at the Black Swan without Temple Bar; Mr. George Strahons, at the Golden Ball, against the Royal Exchange in Cornhill; Mr. Timothy Childs, at the White Hart, the West End of St. Paul's Church Yard; Mr. Arthur Bettesworths, at the Red Lion on London Bridge; Mr. Charles King's, at the Judges Head in Westminster Hall; Mr. John Smiths, at the Post House in Russell Street, Covent Garden, Bookseller."

The project was set out in much detail, but I shall only cite one passage.

"By the foregoing Articles and scheme, it appears plainly how the Joint Stock will arise and increase, so as in 9½ years to give upwards of £5,000 interest per annum for ever, to be divided yearly amongst the claimants of the deceased persons insured upon in this Society, who cannot be supposed (according to the best computations that can be made) to increase 20 in number each year; for by Sir Wm. Petty's calculations in his Political Arithemetic, of the number of people inhabiting within the Bills of mortality, and the computation of several others, very curious and exact that way, being compared with the weekly bills, it appears that of all this people in turn, calculating, young children, decrepit, aged and distempered persons, not 1 in 50 dies in a year; therefore it may be modestly supposed that not above 1 in 100 (if so many) will die in a year out of those insured upon in this Company: because they must be persons in the vigour of age, neither young nor old, nor labouring under any manifest distemper; and 1 in 100 amounts to 20 in 2,000 (the number of members proposed), amongst whose claimants the sum of £5,000 being divided will be £250 each; will fully make good what was advanced in the former part of these papers, viz.: That every member of such a Company, their lives, etc., would receive £50 for the first £5 they pay to the Joint Stock, and £25 for every other £5 they pay, or within a trifle of it, whenever the person they insure upon die."

4. On the 18th December was issued: "*Articles for Establishing an Hereditary Company for the Benefit of the Present and Succeeding Generations.*" It was to consist of 2,000 persons "more or less of either sex." The following indicates that the two Societies of 1699—the first Life Assurance Associations

formed in this country—had run their career:—"2. That all such "persons and no others as were Subscribers of the late Societies "of Assurance for Widows and Orphans kept in Racquet Court, "in Fleet Street, may or shall be admitted into this *Hereditary* "Company, without any limitation in respect of age and time of "probation only, in as full a manner as if the said Societies of "Assurance were now standing and on foot, provided as such enter "within three months from the date hereof; but subject never-"theless to all the rest of these Articles following." Each subscriber was to pay up the sum of £25, by certain specified instalments, the aggregate of which Contributions were to be invested in Parliamentary Funds, "or other public or private securities," and the interest resulting, not exceeding 7 per-cent, was to be equally divided among the claimants under nominee policies, whose claims had been proved during the year.

The year 1714 showed a healthy falling off in Life Assurance projects. There were one or two which require particular mention here.

1. *London Insurers on the Lives of Men, Women and Children,* for the benefit of themselves, their executors, administrators and assigns, for ever. The proposals were stated to have been approved by Sir Robert Raymond, Her Majesty's Solicitor-General, and Richard Richardson, Serjeant-at-Law. They were to be obtained at the Company's office "in Fountain Court, over against Gutter Lane, in Cheapside, and from most Booksellers in London and Westminster." The proposer of the scheme was Mr. William Adams. The project was most confused in its details, but the leading idea was that each of its 2,000 members should contribute £4 per annum for ten years, making in all £80,000. The interest resulting from this stock to be divided every two years amongst claimants, and the sum expected to be realized was £200. "That "person which claimeth from one policy twice in sixteen years "will clear, besides all charges, the sum of £350; those that "claim thrice, £500; and so up to those who claim eight times "in sixteen years, who will gain £1,250. . . . . So in this, you "see, a person has an opportunity of gaining every two years a "considerable sum of money; and so it will continue for ever". How all this was to be accomplished remained a mystery.

2. There was something of a rupture among the members of the *Amicable* Society (1706) this year, in consequence of the proposal for reducing the future annual contribution. As a result, it was proposed to found a new association, with a like number of

members but a smaller contribution, "at Owens' Coffee-house, at Simmond's Inn, Chancery Lane"; but what became of the project does not appear.

3. "At Lorimers' Hall (commonly call'd Loriners' Hall), in "London Wall in the Postern, near Basinghall Street, over against "the Green Yard, this day subscriptions are taken in for erecting "the *British Society* for granting policies on the lives of 650 "persons, for £300 each policy, which is contrived in a method "entirely new, where the profits are much greater, the payments "or claims three times as large, more secure, and sooner paid "than in any other society. The subscribers will have money "lent 'em to pay contributions, after five years, &c., &c."—*Vide Postboy,* 6 March 1714. This looks like an early instance of applying the office value to keep up the policy.

4. "Proposals for an Annual Dividend on the lives of men, "women and children, by quarterly contribution, whereby each "contributor (having a lawful claim according to the Articles con-"tained in the proposal) shall certainly receive the principal "money by them paid, with interest and other considerable advan-"tages, once a year. Proposals are given gratis at the 'Black "Key and Anchor,' in Cannon Street. *Note.*—This is the first "undertaking of this nature that was ever published, as may "appear by the said proposals."

This was probably the beginning of the system of "Little Goes" in Life Assurance, which soon became very general; but which I do not propose to enter upon further, for they had no legitimate connection with the business.

In 1715 there was founded the *Perpetual Insurance on Lives,* at the "Blew Leg," in Bow Lane, near Watling Street. The scheme was this:—"A person may subscribe on the life or lives "of any person or persons, of any age, sex, condition, or constitu-"tion, with or without their knowledge or consent, paying 1*s.* "entrance and 6*d.* per month, and upon the death of their "nominee will receive the benefit, which early or later will be "very considerable. And for the further benefit of the sub-"scribers, this insurance is divided into 24 classes; so that one "life may be insured upon in one or more class, and dividends "received accordingly. A subscriber may contribute from 6*d.* "per month to 1*s.*, 2*s.*, 3*s.*, 5*s.*, 10*s.* or 12*s.* per month on one "life; but for the ease of the contributors who shall subscribe "through the classes, they may have three entries on interest to "one on principal, which reduces the charge on each life, though "insured through the 24 classes, to 3*s.* 9*d.* per month; for which

"the insurer will receive (computing 5 claims in 100 yearly), if "the life drop, in the first year, £50; in the second year, £100; "in the third year, £150; in the fourth year, £200. The divi- "dends were paid monthly, and land security given for performance "of the Articles." This was a scheme of Tontine classes.

The managers advertised in November 1715, that "the number "subscribed since midsummer last is betwixt 3,000 and 4,000"; and it was added, "all persons, unless entered before 1st January "next, must live nine months before they can claim."

In 1716 the only scheme advanced which calls for any notice here is the *Generous Society of Insurance on Lives of Men, Women, and Children, by a Monthly Dividend*; "with provision "for persons that shall fall sick or lame, and for putting out "several hundred children apprentices, which for the better "regulation and greater security of the subscribers, are agreed to "be inroll'd in the High Court of Chancery." "The Articles" of this project were published in a pamphlet bearing the title: *Youths' Way to Heaven, or Breathings of Pious Souls; with the Lives of the Apostles of Jesus Christ; and the Primitive State of Christianity, &c. Collected for the use of Religious Families, and given gratis to all Subscribers' Children.* "London: Printed "for and sold by the Society, at Mr. A. Goldsmith, at the 'Black "Moor's Head,' against Mr. D'Oiley's, near Exeter Exchange, in "the Strand; and at Mr. Isted's, a Bookseller, against St. Dun- "stan's Church, Fleet Street, 1716." The tract is dedicated "to Their Graces, William, Lord Arch-Bishop of Canterbury, "William, Lord Arch-Bishop of York, and also to the Bishops and "Clergy of England, &c.," followed by a fulsome address. The nature of the scheme may be judged by the following specimen: "6. The sum of £125 per month shall be deposited by the "registrar, to be an improving stock, to be apply'd to advance "subscribers' claims, though the life should be of forty years' "continuance, if full or proportionable." I will not quote more of this brazen scheme. It is only introduced here as a necessary part of the history of Life Assurance. One can only describe such projects by following the language of their promoters. There were to be 4,400 subscribers. We hear no more of it.

The events of 1717 call for at least a passing notice.

1. *Mr. Hartley again.*—I have noticed the circumstances under which the founder of the *Amicable* (1706) left that office in 1713. He now issued "Proposals for erecting and Establishing a new Society for Insuring Lives by the name of *Great Britain's Royal*

Society "for securing to any person or persons or their assigns "for ever several great sums of money out of the Annual Dividends "among the Contributors on the death of their Nominees. By "John Hartley, Registrar and Sole Inventor of the Amicable "Society for a perpetual Assurance established by Charter." The new scheme was framed much on the same lines as the *Amicable.*

2. From the Office belonging to the "*Most Generous, Most "Beneficial and consequently Most Friendly Society,* Insuring "on Lives, held near the King's Head in Broad Street, almost "against the Pay Office", was issued the following announcement: "Having observed an utter dislike to all Proceedings by "Dividends occasioned by the many opportunities their Articles "usually give of Favour and Fraud, whereby several Gentlemen "and others may and have been very much imposed on to the "great Dishonor of all Insuring on lives which in itself is very "Honest and Innocent; now to redress the aforesaid grievance, "this Author hath most carefully taken away the cause and "Invented a new Perfect, and Secure Method of Proceeding, "whereby to acquire any single certain sum for claim from £10 "to £100 at the death of each Nominee, having lived 6 calender "months after Entrance, that you please to contribute for, without "being out of pocket, even for Insuring on 6 persons lives in any "Section, so much as one claim of that section amounts to in 9 "years. At which time all monthly Contributions will cease by "such as have so long contributed, and you and your posterity "have gained an inheritance in this Society. You'll have bank "security for the first year, and the money will circulate ever "afterwards at 5 per-cent per annum amongst the members of "the Society. Subscriptions are taken in and abstracts delivered "out Gratis at the Office aforesaid." No further details are given.

In the 3rd Edition of Blount's *Law Dictionary*, published this year there is the following incoherent account of Life Assurance as then practised, under the title, "Policy."

"And 'tis of late become a Custom to insure mens lives in "Offices who have paid great sums of money for the purchase "thereof, and are insured for that adventure by a certain Company "of Merchants or Citizens, for three or four per cent. Subscribing "or underwriting the agreement, policy or Insurance, who do "among them share the money given by the party insured, and "run the hazard of it. Such Assurance or policies being not "seldom also used in other matters when loss or damage is "feared."

The year 1718 presented several new projects:

1. "An Office for a perpetual Insurance of Lives of Men, "Women and Children will be erected in a few days whereby "such as subscribe thereto (at an inconsiderable expense) will "secure a certain Provision to themselves their heirs and assigns "for ever. The charge for Insurance at most exceeds not £5 per-"cent. The advantages great and certain, and the security "undeniable. Proposals of this Insurance and Abstracts thereof "will be given Gratis as soon as the Articles of Settlement can "be executed, which are now drawing up in form by advice of "Council. The office will be kept in Red Lion Court, Fleet St., "of which further notice shall be given. There will be good "encouragement for early Entrances. Persons may gain from "£5 to £40 on each life before they have paid 20*s*."

2. A new office at the "Blue Leg, in Bow Lane, Cheapside," "namely: "A proposition for raising perpetual advantages to all "persons and their Assigns, who shall subscribe thereto, whereby "at as small expense as they please they may obtain perpetual "benefit proper for all persons in general and founded upon such "approved methods as cannot fail to answer the ends proposed" &c., &c.

The year 1719 witnessed the first of a series of attempts to obtain Charters for carrying on the business of Life Assurance by indirect means, namely, by the purchase of Charters which had been previously granted for other purposes. Thus in 1690 (2nd Will. & Mary), there had been granted an Act to Incorporate the proprietors of the Water Works in York Buildings in the Strand, and for encouraging, carrying on, and settling the said Water Works. Whereupon that Company had become Incorporated by the name of "*The Governor and Company of the Undertakers for raising House Water in York Buildings,*" with power to purchase lands, &c. This power to purchase land was employed to purchase forfeited Estates in Scotland; and Parliament had declared that any Corporation purchasing such Estates might grant Annuities. With the power of granting Annuities, the purchasers of the defunct Charter had associated the granting of Life Assurances. The *Amicable* Society, as the only Chartered Life Office then existing, drew the attention of the law officers of the Crown to the new movement. The matter, with various other Insurance projects, came before the Privy Council. The purchasers of the Charter petitioned to be granted Incorporation as "*The Governor and Company for purchasing and improving Forfeited and other*

Estates in Great Britain, for granting Annuities for Life, and for Assuring Lives." The Attorney-General reported that the first part of the proceedings constituted a misuse of the powers of the original Corporation; and that it was not desirable to grant any new Charters for the purposes last stated. This was known in Change Alley as "Billingsley's Scheme." It was supported by the Earl of Westmorland, Earl of Uxbridge, Earl Delarane, Lord Percival, The Lord Bishops of Bristol, Bangor, &c., and "several hundreds more of your Majesty's faithful and loyal subjects."

There was also set on foot this year, 1719, a rival scheme known as "Hallett's," concerning which there is excellent evidence at hand, namely, a Copy of the Petition lodged by the Promoters with the Privy Council.

> "The Humble petition of Sir James Hallet, Knight, together with the underwritten Merchants and others (to the No. of about 113), your Majesty's Loyal and dutiful subjects, in behalf of themselves and the rest of the Subscribers to fund of £1,200,000 for granting Annuities, securing fortunes, to Widows, Orphans, and others, settling Jointures on Marriages, and Insuring of Lives, &c., humbly sheweth:

"That it will be of very great advantage to the Widows, Orphans and other subjects of these your Majesty's Dominions in general, could they have a safe and satisfactory security to resort to for purchasing Annuities, whereby to improve their small fortunes, and enable them to live comfortably without ever becoming burdensome to their friends, or by time to waste their Capital and be thereby reduced to poverty and want.

"That it would also be of great advantage to the Subjects of these His Majesty's Realms, especially such of them as are in trade, to use in such their trade the greatest part of the fortunes they may receive with their wives; and which they might much the better do could they, by laying out some part of the said fortunes, secure a sufficient competency for their wives to live and subsist upon, in case they should by the chance and hazard of Trade either fail or die, without a capacity to make any other provision for them.

"That it would also be serviceable to his Majesty's Subjects *could they safely and securely insure upon their lives;* which would encourage merchants to be more bold in their undertakings, because in case of the death before their Schemes in trade succeeded, their widows and families might thereby receive a benefit in a great measure to recompense the failure of such their undertakings. That persons in good offices and employments for life may for the same reason be induced to make provision for their families, who during their lives have an opportunity of maintaining them in good credit, but at their death very often leave them in slender circumstances.

"That your petitioners do not desire to exclude private persons from purchasing and improving Estates, Granting Annuities, or assuring lives, nor to intermeddle with the business of any other Corporation. . . . Hence they pray for Incorporation."

It would be very difficult to find any modern prospectus which sets forth the uses and advantages of Life Assurance in more terse and understandable words than does this petition, dating back to the reign of the first George. The Law Officers decided and advised His Majesty that it would not be advisable to erect any such incorporation.

A Review of the preceding Twenty Years.

The year 1720 is a memorable one in English History. It is hardly less so in Life Assurance History. An atmosphere of speculation had pervaded the Metropolis from the commencement of the Century. In the crude Life Assurance project of 1699, a new mode of aggregating wealth had been propounded. The notion, having taken hold of the public mind, was skilfully but unscrupulously worked by projectors of new schemes. Each year more attractive projects were put forward. The very unsoundness of the schemes enabled unscrupulous persons to realize promptly by putting forward for assurance unhealthy lives. In a Mutual Contribution Society, the Managers have no special reason (apart from motives of honour) to object to the introduction of lives of the worst class. They receive the entrance fees and the percentage deduction from the claims; the more that enter, the more the Managers make personally, as the Subscribers themselves pay the claims; the more claims that are paid, the more rapidly contributors come in. Time alone can dispel the illusion.

The movement, now inaugurated, of founding Joint-Stock Insurance Companies, shows that the earlier system was becoming exploded. The merits of Life Assurance were growing increasingly apparent. The people now said,—Give us solid Institutions to insure in. Hence the two projects of 1719; hence also several other attempts in the early months of this year: for instance,

1. A Copartnership for Insuring and Increasing Children's Fortunes, held at the Fountain Tavern.
2. Symond's Assurance on Lives.
3. Baker's Second Edition of Assurance on Lives. (The first was a scheme of Annuities.)
4. Le Brun's Marriage and Widows' Assurance Company.

Simultaneously with the Life Assurance projects here already enumerated, there had been projected hundreds of other Insurance Schemes and of Joint Stock enterprises, altogether apart from

Assurance, almost from the commencement of the Century. One of these outside projects—outside Insurance I mean—was The *South Sea Company,* founded in 1710, for the assumed purposes of Trade and Emigration. The Stock in this Company became a favourite one with Speculators, and had gradually risen to an enormous degree of inflation from par (£100) to over £800. Many circumstances seem to point to the fact that money made in Insurance projects passed into South Sea Stocks, certainly some of the young Assurance Offices invested their members' money in these Stocks, and advertised that they had done so. I am disposed to think that the promises of some of the later Assurance Societies enumerated were founded upon the results of past operations, and a belief that such opportunities would be continued. To what precise extent the various projects of this eventful period were interlaced, it is now impossible fully to unravel. Certain it is that with the bursting of the South Sea bubble *every one of the Life Assurance projects of which I have already given a record, with the single exception of the Amicable* (1706), *passed into thin air and were heard of no more.*

By way of adding to the confusion of the period (although not so intended) there came the passing of the "Bubble Act"—6 George I., Chapter 18:—"An Act for the suppression of Bubble Companies," which recited (Section 18), "Whereas it is notorious "that several undertakings or projects of different kinds have at "some time or times since 24 June 1718 been publicly contrived "and practised, or attempted to be practised within the City of "London and other parts of the kingdom and also in Ireland, and "other His Majesty's Dominions, which manifestly lend to the "common grievance, prejudice, and inconvenience of great Nos. "of your Majesty's Subjects, in their trade or commerce and other "their affairs; and the persons who contrive or attempt such danger-"ous and mischievous undertakings or projects under pretence of the "public good, do presume according to their own devices to open "books for public subscriptions, and draw in many unwary "persons to subscribe therein, towards raising great sums of "money; . . . . . and whereas in many cases the said "undertakers or subscribers have since the said 24 June 1718 "presumed to act *as if they were corporate* bodies, and have "pretended to make their shares or stocks transferable *or "assignable, without any legal authority either by Act of "Parliament,* or by any Charter from the Crown for so doing." . . . . It was therefore enacted, that all such undertakings

and all subscriptions thereto should from and after 24 June 1720 be deemed illegal and void. The effect of this measure was to kill the more solid of the later Insurance Associations—those that had a capital at their back—in favour of other weaker associations which had no legal status to support them, and which would almost necessarily succumb in the panic which prevailed.

I have tried to estimate the extent of the dealings of the many Mutual Contribution Life Assurance Offices which passed out of sight in the year 1720. It is not possible to define the amount of Assurances they had in force. That in the nature of the case was always an unknown quantity. We can only estimate the aggregate of the Contributions, as against the aggregate returns made by the Offices to their Subscribers; the balance constitutes the loss to the public. There had probably been some fifty Life Assurance schemes set on foot between 1699 and 1720. Of about forty of these I have already given a more or less detailed account. Some "entered lives" by thousands, and others by hundreds only. Some lived for many years, others for very few. If we estimate the average duration to have been five years, and the average receipts in the way of Entrance payments, Contributions towards Claims and to the Management, at £5,000 each (a very small estimate in view of scattered facts learned during my investigations), we have a total of £250,000—which, at the current rate of £5 per £100, would have insured *five millions* sterling. Probably two-fifths, £100,000, of the Contributions had been returned in the way of Claims, &c., leaving the loss to the public at £150,000.

The Life Assurance Companies of the United Kingdom.

In the belief that our readers will consider it desirable and advantageous, that in this *Journal* there should be reproduced matters of interest and importance that have appeared in other publications, we annex the Summaries of the Accounts filed with the Board of Trade by life assurance companies in 1883 and 1884. The statements now given are taken from the Appendices to the Blue-Books for these years; and it should be pointed out that, as the figures printed at the head of the columns denote the years in which the Returns were filed, the information conveyed by the Summaries will, generally speaking, relate to the operations of the companies in the previous year.

THE LIFE ASSURANCE COMPANIES OF THE UNITED KINGDOM.

Summary of the Life Assurance and Annuity Revenue Accounts.

INCOME	1883			1884		
	Ordinary Companies	Industrial Companies	Total	Ordinary Companies	Industrial Companies	Total
	£	£	£	£	£	£
Balance at the beginning of the Year	132,716,573	1,993,345	134,709,918	137,010,924	2,273,907	139,284,831
Adjustments *	−191,979	...	−191,979	+59,889	−2,322	+57,567
	132,524,594	1,993,345	134,517,939	137,070,813	2,271,585	139,342,398
Premiums	12,163,838	2,602,438	14,766,276	12,307,152	3,059,264	15,366,416
Consideration for Annuities	610,137	...	610,137	636,510	...	636,510
Interest and Dividends (less Tax)	5,652,716	71,921	5,724,637	5,765,562	91,991	5,857,553
Increase in value of Investments	188,045	1,629	189,674	125,900	1,003	126,903
Fines, Fees, &c.	6,801	421	7,222	6,865	155	7,020
Capital Paid-up	16,268	32,430	48,698	3,704	1,046	4,750
Customs Timber Measuring, &c.	2,017	...	2,017	2,871	...	2,871
Donations (Itinerant Methodists)	3,330	...	3,330	3,174	...	3,174
Transfers from other Accounts	101,971	...	101,971	14,890	...	14,890
Miscellaneous	2,420	633	3,053	4,693	610	5,303
	151,272,137	4,702,817	155,974,954	155,942,134	5,425,654	161,367,788

* (1883) For three Returns discontinued (−£3,170); for portion of funds (including £151,518, Paid-up Capital) not transferred by the London and Provincial Law to the Guardian on the transfer of their business (−£211,875); and for one new Return (+£23,066).
(1884) For one Return discontinued (−£14,700); for capital transferred to life account in the case of two companies which have discontinued fire business (+£50,000) and (+£24,589); for three Industrial Returns discontinued (−£1,620, −£426, −£276).

Summary of the Life Assurance and Annuity Revenue Accounts—(continued).

OUTGO		1883			1884		
		Ordinary Companies	Industrial Companies	Total	Ordinary Companies	Industrial Companies	Total
		£	£	£	£	£	£
Claims		9,870,228	957,350	10,827,578	10,618,945	1,124,622	11,743,567
Cash Bonuses and Reduction of Premiums		835,201	...	835,201	915,147	...	915,147
Annuities		573,235	15	573,250	593,151	15	593,166
Surrenders		751,349	4,361	755,710	773,331	4,886	778,217
Commission		534,904	770,419	1,305,323	548,275	880,098	1,428,373
Expenses of Management		1,143,526	430,124	1,573,650	1,140,979	461,473	1,602,452
Bad Debts		12,068	1,188	13,256	2,914	932	3,846
Decrease in value of Investments		33,892	...	33,892	27,964	500	28,464
Interest on Capital, and Dividends and Bonuses to Shareholders		490,152	123,345	613,497	564,290	5,734	570,024
Transfer to other Accounts		5,087	142,108	147,195	2,592	145	2,737
Miscellaneous:							
Interest on Claims	£1,765						
Balance of Re-assurance Account	6,528				3,738	...	3,738
Investment Reserve	2,000						
Sundries	1,278						
		11,571	...	11,571			
*Balance at the end of the Year		137,010,924	2,273,907	139,284,831	140,750,808	2,947,249	143,698,057
		151,272,137	4,702,817	155,974,954	155,942,134	5,425,654	161,367,788

* This Balance includes the Life and Annuity Funds (for 1883, £134,087,925; 1884, £138,443,389) and the Capital of those Companies whose business is limited to Life Assurance only.

Summary of the Balance Sheets.

LIABILITIES	1883			1884		
	Ordinary Companies	Industrial Companies	Total	Ordinary Companies	Industrial Companies	Total
	£	£	£	£	£	£
Paid-up Capital (including sundry Shareholders' Balances)	11,443,685	118,041	11,561,726	11,369,659	114,289	11,483,948
Life and Annuity Funds	131,922,246	2,165,679	134,087,925	135,604,632	2,838,757	138,443,389
Fire Funds of Companies transacting Life business	7,094,055	...	7,094,055	7,699,308	...	7,699,308
Marine Funds of Companies transacting Life business	506,246	...	506,246	561,208	...	561,208
Reserve Funds	3,368,386	...	3,368,386	3,382,256	...	3,382,256
Other Funds	405,436	981	406,417	430,183	515	430,698
Profit and Loss Balances	1,825,414	...	1,825,414	2,122,172	...	2,122,172
Depreciation and Investment Balances	166,800	100,000	266,800	176,565	100,000	276,565
Globe Annuitants (Liverpool and London)	1,102,800	...	1,102,800	1,102,800	...	1,102,800
Outstanding Claims	4,303,962	23,112	4,327,074	3,580,647	10,729	3,591,376
Outstanding Accounts	448,230	2,441	450,671	411,096	995	412,091
Temporary Loans	...	...	...	209,756	...	209,756
Sundries	35,619	1,500	37,119	8,315	...	8,315
	162,622,879	2,411,754	165,034,633	166,658,597	3,065,285	169,723,882

Summary of the Balance Sheets—(continued).

ASSETS	1883			1884		
	Ordinary Companies	Industrial Companies	TOTAL	Ordinary Companies	Industrial Companies	TOTAL
	£	£	£	£	£	£
Mortgages	72,634,057	111,907	72,745,964	74,282,393	99,001	74,381,394
Loans on Policies	7,544,874	4,073	7,548,947	7,806,172	4,592	7,810,764
„ Rates (and Rent-charges)	21,013,617	627,320	21,640,937	21,095,748	935,727	22,031,475
British Government Securities	4,766,929	297,521	5,064,450	4,662,518	347,418	5,009,936
Indian and Colonial Government Securities	8,808,808	8,270	8,817,078	9,380,817	8,270	9,389,087
Foreign Government Securities	4,286,736	...	4,286,736	4,066,533	...	4,066,533
Debentures	11,494,305	67,691	11,561,996	12,204,869	142,374	12,347,243
Shares and Stocks	9,807,588	8,513	9,816,101	9,929,528	...	9,929,528
Companies' own Shares	593,530	...	593,530	618,690	...	618,690
Land and House Property, and Ground Rents	8,416,872	954,944	9,371,816	8,890,157	1,149,588	10,039,745
Life Interests and Reversions	2,934,861	44,537	2,979,398	2,949,862	46,458	2,996,320
Loans on Personal Security	1,447,390	22,621	1,470,011	1,389,050	16,497	1,405,547
Agents' Balances and Outstanding Premiums	3,293,896	144,123	3,438,019	3,433,696	194,908	3,628,604
Outstanding Interest	1,461,375	22,672	1,484,047	1,495,159	31,793	1,526,952
Cash, Bills, Stamps, &c.	3,846,333	89,810	3,936,143	4,288,278	84,067	4,372,345
Customs Timber Measuring Balances, &c.	2,872	...	2,872	2,702	...	2,702
Book-Room Grant (Itinerant Methodists)	75,000	...	75,000	75,000	...	75,000
Sundries*	80,051	...	80,051	4,407	...	4,407
Deficiencies, Preliminary Expenses, &c.	113,785	7,752	121,537	83,018	4,592	87,610
	162,622,879	2,411,754	165,034,633	166,658,597	3,065,285	169,723,882

* Including £75,000 due from the London and Provincial Law to the Guardian.

INCREASE (+) *or* DECREASE (—) *in the Chief Items of each Year's* SUMMARY, *when compared with the corresponding Items for the previous Year.*

	1883		1884	
	Ordinary Companies	Industrial Companies	Ordinary Companies	Industrial Companies
INCOME	£	£	£	£
Premiums	+ 265,704	+356,873	+ 143,314	+456,826
Consideration for Annuities	+ 13,916	...	+ 26,373	...
Interest and Dividends (less Tax)	+ 164,910	+ 11,715	+ 112,846	+ 20,070
Net Increase in Value of Investments	— 18,993	+ 1,629	— 56,217	— 1,126
OUTGO				
Claims	+ 125,549	+177,365	+ 748,717	+167,272
Annuities	+ 41,399	...	+ 19,916	...
Surrenders	+ 37,404	+ 1,252	+ 21,982	+ 525
Commission	+ 17,232	+101,949	+ 13,371	+109,679
Expenses of Management	— 2,502	+ 16,892	— 2,547	+ 31,349
LIABILITIES				
Paid-up Capital (including sundry Shareholders' Balances)	+ 52,715	+ 33,974	— 74,026	— 3,752
Life and Annuity Funds	+4,221,323	+249,654	+3,682,386	+673,078
ASSETS				
Mortgages (including Loans on Rates and Rent-charges)	+3,253,873	+247,483	...	...
Mortgages	...	...	+1,648,336	— 12,906
Loans on Rates and Rent-charges	...	...	+ 82,131	+308,407
Life Interests and Reversions	+ 104,536	+ 2,418	+ 15,001	+ 1,921
Loans on Policies	+ 242,199	+ 1,226	+ 261,298	+ 519
British Government Securities	— 261,033	+ 62,925	— 104,411	+ 49,897
Indian and Colonial Government Securities	+ 539,552	— 360	+ 572,009	...
Foreign Government Securities	— 33,888	...	— 220,203	...
Debentures	+ 201,947	— 5,263	+ 710,564	+ 74,683
Shares and Stocks	+1,061,977	+ 8,513	+ 121,940	— 8,513
Companies' own Shares	+ 15,769	...	+ 25,160	...
Land and House Property and Ground Rents	+ 96,585	+ 84,660	+ 473,285	+194,644
Loans on Personal Security	— 70,977	— 1,125	— 58,340	— 6,124

CORRESPONDENCE.

SOLUTION OF A PROBLEM.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—In my paper entitled "How dos an Increast Mortality afect Policy-Values?" (*J.I.A.* xxi, 98) I proposed for solution a problem which may be stated thus:

If $$\frac{1+a_x}{1+a_{x+1}} > \frac{1+a'_x}{1+a'_{x+1}} > 1,$$

then will $$\frac{a_x}{v(1+a_x)} > \left(\frac{1}{1+a'_x} - \frac{1}{1+a_x}\right)\frac{1}{v-v'};$$

a'_x being the value of an annuity calculated by the same mortality table as a_x, but at a higher rate of interest. I have recently received from Mr. J. C. Hopkinson a solution of the problem, which you may perhaps think worthy of being brought under the notice of your readers.

We have $$\frac{1+a_x}{1+a'_x} - 1 = \frac{a_x - a'_x}{1+a'_x}$$

$$= \left(\frac{a_x}{a'_x} - \frac{1+a_x}{1+a'_x}\right)a'_x$$

$$< \left(\frac{a_x}{a'_x} - \frac{1+a_{x+1}}{1+a'_{x+1}}\right)a'_x$$

$$< \left\{\frac{a_x}{a'_x} - \frac{v'}{v}\cdot\frac{vp_x(1+a_{x+1})}{v'p_x(1+a'_{x+1})}\right\}a'_x$$

$$< \left(\frac{a_x}{a'_x} - \frac{v'}{v}\cdot\frac{a_x}{a'_x}\right)a'_x$$

$$< a_x\cdot\frac{v-v'}{v}.$$

Then dividing both sides of this inequality by $(v-v')(1+a_x)$, the desired result at once follows. It will be observed that we have made no use of the condition that $\frac{1+a_x}{1+a_{x+1}}$ and $\frac{1+a'_x}{1+a'_{x+1}}$ are both >1; and it seems that this condition is unnecessary, and that it would be

sufficient to have $\frac{1+a_x}{1+a_{x+1}} > \frac{1+a'_x}{1+a'_{x+1}}$. It is worth noticing that this inequality leads to

$$\frac{vp_{x-1}(1+a_x)}{vp_x(1+a_{x+1})} > \frac{v'p_{x-1}(1+a'_x)}{v'p_x(1+a'_{x+1})},$$

whence

$$\frac{a_{x-1}}{a_x} > \frac{a'_{x-1}}{a'_x}.$$

I am, Sir,
Your obedient servant,
T. B. SPRAGUE.

26 *St. Andrew Square,*
Edinburgh,
9 *May* 1885.

INSTITUTE OF ACTUARIES.

PRELIMINARY EXAMINATION, 1885.

Examiners.—G. H. RYAN, Esq.; G. TODD, Esq., M.A.; WM. VAUGHAN, Esq.; W. J. H. WHITTALL, Esq.

I.

1. State the principle of book-keeping by double entry, and enumerate its advantages.

2. A company buys fourteen shares in the Suez Canal, and pays £984. 18*s*. During the year it receives two dividends amounting to £18. 18*s*. and £28 respectively, and also has one of its shares drawn for redemption at par, namely, £20. What journal entries are necessary to record the purchase, the receipt of dividends, and the redemption; it being understood that redemption does not cancel the right to future half-yearly dividends, but merely reduces them by 10*s*. each, the interest at 5 per-cent on the capital returned?

3. Find the value correct to five decimal places of either of the following series:

$$\alpha.\quad 16\left\{\frac{1}{5}-\frac{1}{3}\cdot\frac{1}{5^3}+\frac{1}{5}\cdot\frac{1}{5^5}-\frac{1}{7}\cdot\frac{1}{5^7}+\&c.\right\}-\frac{4}{239}.$$

$$\beta.\quad 6\left\{\frac{1}{1}\cdot\frac{1}{2}+\frac{1}{2}\cdot\frac{1}{3}\cdot\frac{1}{2^3}+\frac{1.3}{2.4}\cdot\frac{1}{5}\cdot\frac{2}{2^5}+\frac{1.3.5}{2.4.6}\cdot\frac{1}{7}\cdot\frac{1}{2^7}+\&c.\right\}.$$

4. Express $\dfrac{\cdot 5-\cdot 1\dot{6}}{266\cdot\dot{6}}$ of £155. 11*s*. as the decimal of a dollar, assuming the value of a dollar to be 4*s*. 2*d*.

5. Solve two of the following equations; one to be selected from each pair:

$$\text{A.}\quad \alpha.\quad \frac{1}{ab-ax}+\frac{1}{bc-bx}=\frac{1}{ac-ax}$$

$$\beta.\quad \frac{\sqrt{x+3}+\sqrt{x-3}}{\sqrt{x+3}-\sqrt{x-3}}=\frac{13+4\sqrt{10}}{3}$$

$$\text{B.}\quad \alpha.\quad \sqrt[2ab]{x^{(a+b)}}-\frac{1}{2c}\left(\sqrt[a]{x}+\sqrt[b]{x}\right)=0$$

$$\beta.\quad \left.\begin{aligned} x\sqrt{\frac{x}{y}}+y\sqrt{\frac{y}{x}}&=34\\ x-y&=12\end{aligned}\right\}$$

6. An engineer had a number of telegraph poles by means of which to extend the wires a specified distance. He found that if he set them 15 yards apart he would have too many by 150; but if he set them 5 yards apart he would have too few by 50. How many poles had he?

7. A person copying a manuscript at a uniform rate of speed finds that the number of lines copied in the first half-hour is less by ten than the square root of the whole number of lines in the manuscript, and that the square of the number of lines copied in the first forty-nine minutes is equal to twice the number of lines then remaining to be copied. How many lines were there in the manuscript, and how many lines per hour did he copy?

8. If there be two series in arithmetical progression, each consisting of n terms and each commencing with the same first term p, one series increasing and the other diminishing by the same common difference q, show that

$$\frac{S_1-S_2}{S_1+S_2}=\frac{q}{p}\cdot\frac{n-1}{2},$$

where S_1, S_2 are the sums of the respective series to n terms.

9. A given length a is sub-divided into n equal parts, each equal to h; what is the sum of the series

$$h(h+2h+3h+\ldots\ldots+\overline{n-1}.h+nh)$$

in terms of a and h? What is the sum when n becomes infinite?

10. Find the sum of n terms of the series

$$ar\left(\frac{1}{a}+\frac{1}{r}\right)^2+ar(1+1)^2+ar(a+r)^2+ar(a^2+r^2)^2+ar(a^3+r^3)^2+\&c.$$

11. The number of permutations of n things taken r together is to the number of permutations of n things taken $r-1$ together as 10 is to 1, and the number of combinations of n things taken r together is to the number of combinations of n things taken $r-1$ together as 5 is to 3. Find n and r.

12. If m denote the number of combinations of n things taken two together, prove that the number of combinations of m things taken two together is equal to three times the number of combinations of $n+1$ things taken four together.

13. How many different sums of money can be formed with nine hundred-pound notes, ten ten-pound notes, eleven sovereigns, and twelve florins, using one or more at a time?

II.

14. Write down the tenth term in the expansion of $(1+x)^n$, and investigate the relation between x and n in order that this may be the greatest term.

15. Prove that

$$\left(\frac{1+x}{1-x}\right)^n=1+n\cdot\frac{2x}{1+x}+\frac{n.\overline{n+1}}{1.2}\left(\frac{2x}{1+x}\right)^2+\frac{n.\overline{n+1}.\overline{n+2}}{1.2.3}\left(\frac{2x}{1+x}\right)^3+\&c.,$$

and employ the result to determine the value of $\sqrt{2}$.

16. Define a logarithm, and prove that the logarithm of a product is equal to the sum of the logarithms of its factors.

Prove that $(ab)^{(\log a-\log b)}=\dfrac{a^{\log a}}{b^{\log b}}$.

17. Find the value of x from the equation $\log x=\sqrt[10]{2}$ having given

$\log 5=\cdot 6989700$, $\log 10717=4\cdot 0300732$, $\log 23594=4\cdot 3728016$,
$\log 10718=4\cdot 0301138$, $\log 23595=4\cdot 3728200$,

18. Express the second difference of the product of two functions in terms of the separate functions and their respective differences, that is, show that

$$\Delta^2(u_xv_x)=u_x\Delta^2v_x+2\Delta u_x(\Delta v_x+\Delta^2v_x)+\Delta^2u_x(v_x+2\Delta v_x+\Delta^2v_x),$$

and by means of the result find $\Delta^2(x\log x)$.

19. Find the Institute H^M 3 per-cent single premium for age 33 from the following table:

Age	Single Premium
30	·392,212
31	·399,340
32	·406,622
34	·421,703
35	·429,503

20. Find the sum to n terms of either of the following series:

$$\alpha.\quad 2.5.8 + 5.8.11 + 8.11.14 + \&c.$$

$$\beta.\quad \frac{1}{2.5.8} + \frac{1}{5.8.11} + \frac{1}{8.11.14} + \&c.$$

21. If u_x be a function of x of the form $b_1x + b_2x^2 + b_3x^3 + \&c.$, *ad infinitum*, show that

$$u_x = b_1 \frac{x}{1-x} + \Delta b_1 \frac{x^2}{(1-x)^2} + \Delta^2 b_1 \frac{x^3}{(1-x)^3} + \&c.$$

22. "If two pennies be tossed, the result will be either two heads or two tails, or one head and one tail. Hence the probability of two heads occurring is $\frac{1}{3}$." Explain the fallacy in this reasoning.

23. A shilling is thrown on a chess-board, one square of which will just include four shillings. Find the chance of its falling clear of a division.

24. Find the chance that a month taken at random will contain portions of six different weeks.

25. From a bag containing twelve balls, six of which are white and six black, five balls are drawn and placed unseen in a box, and from the box a white ball is drawn and replaced five times in succession. What is the probability that the box contains three white balls and two black?

INTERMEDIATE EXAMINATION, 1885.

Examiners—A. F. Burridge, Esq.; Geo. King, Esq.; A. W. Sunderland, Esq., M.A.

I.

1. An annuity of c per annum is to be granted to redeem in n years a debt of K, the creditor to realise interest at rate i on his advance, and the sinking fund to accumulate at rate j. Find c; and show how much of the debt will remain still outstanding at the end of t years.

2. In a stationary community there are 209 deaths annually to each 10,000 inhabitants. What is the average age at death?

3. Define the function called by Dr. Farr the Rate of Mortality; and find the relation that exists between it and the function that usually goes by that name.

4. The value, at 4 per-cent interest, of a Policy for £1 effected n years ago on a life then aged x is ·11010. Find the value of the sum assured, and the value of the future premiums; having given $P_x = \cdot 01669$.

5. Find the annual premium for a deferred annuity to (x); all premiums paid to be returned with compound interest in the event of the life dying before the annuity is entered on.

6. Show how, from an ordinary commutation table, to construct by a continuous method a table of annual premiums.

7. If a be the value of an annuity on (x), and e the complete expectation of life, prove that, by De Moivre's hypothesis,

$$a = \frac{2e - (1+i)a_{\overline{2e}|}}{2ie}.$$

8. Find the probability that at least two lives out of four lives will survive a year. Give a general expression for the probability that at least r lives out of m lives will survive n years.

9. Find, in terms of joint life annuities, an expression for the value of an annuity payable only while *exactly* r lives out of m lives survive.

10. Define the commutation symbols

$$D_x,\ N_x,\ S_x,\ M_x,\ R_x,$$

and prove the equations connecting them.

11. State and prove the rule for finding, by means of Orchard's Tables, the single and annual premiums for an endowment assurance.

12. Give an algebraical proof of the formula

$$a_{\overline{abc}.\overline{xyz}} = a_{\overline{abc}} + a_{\overline{xyz}} - a_{\overline{abcxyz}},$$

and show by argument that the result is correct.

13. There are two expressions for the value of a reversionary annuity to (x) after (y), namely:

$$\Sigma v^n({}_np_x - {}_np_{xy}),\ \text{and}\ \Sigma v^n \frac{l_{x+n}d_{y+n-1}}{l_x l_y}(1 + a_{x+n}).$$

Give an algebraical demonstration that these are identical.

II.

14. A debt, C, repayable by instalments at fixed epochs, and carrying interest at rate i on the portion which remains from time to time outstanding, is to be bought by a purchaser at such a price as to pay him a rate of interest j on his capital. Prove that the sum he must give for the debt is

$$A = K + \frac{i}{j}(C - K),$$

where K is the present value at rate j of the instalments of C.

15. Give briefly particulars of the various mortality tables that have been formed from time to time from the experience of the Government life annuitants.

16. Sketch a form of acceptance letter of a life proposal; and call special attention to the provisions that in your opinion it should embody.

17. Show how to construct by a continuous method tables of policy-values of endowment assurances. What precautions would you take to check the results?

18. Find the probability that (x) will die before (y), or within t years after the death of (y).

19. Having given a_x, and the value of an annuity on (x), commencing at κ payable at the end of the first year, and increasing c per annum; find the value of the corresponding assurance, commencing at κ if death occur in the first year, and increasing c per annum.

20. Find the value of $\bar{A}_{x\overline{n}|}$.

21. Mr. Holmes Ivory gave the expression $a_x - a_{xy} - \frac{m-1}{2m} A^{\,1}_{xy}$ for the value of a reversionary annuity. Give the reasoning by which the expression may be derived, and explain exactly the nature of the reversionary annuity so represented.

22. An estate is held in perpetuity on successive lives, on the conditions that, from the end of the year in which each successive life drops, a period of t years is to elapse before a new life is nominated, and that a fine is to be paid at the beginning and at the end of each such period. Find the value of all the future fines.

23. How would you obtain the "expectation of claims" on the following classes of assurances?

(*a*) Whole life policies.
(*b*) Joint life policies.
(*c*) Last survivor policies.

24. Find the annual premium, P′, for an assurance of 1, the premium to increase κ at intervals of t years, there being r of such intervals. Also, having given P′, find κ. In practice, what is the limit of P′?

25. Having given complete D and N columns for single and joint lives, and also a table of M^1_{xy} for $x<y$; find ${}_t|A^1_{xy}$, ${}_t|A^2_{xy}$, ${}_t|A^1_{xy}$, and ${}_t|A^2_{xy}$.

FINAL EXAMINATION, 1885.

Examiners.—M. N. ADLER, Esq., M.A.; GEO. HUMPHREYS, Esq., M.A.; WM. SUTTON, Esq., M.A.

I.

1. Assuming that you have been asked to advise a large friendly society of long standing, which grants sick pay and death benefits and children's endowments, describe the particulars you would call for in order to make a valuation of the society's contracts with its members by means of tables to be specially computed from the society's experience.

2. Describe briefly but definitely the methods used in the graduation of the following mortality tables:

Institute of Actuaries' H^M (Mr. Woolhouse).
Peerage Males (Mr. Berridge).
Government Annuitants (John Finlaison).

Describe the "Graphic" method of graduation and give your opinion of it, with reasons.

3. Give Gompertz's formula. What is Mr. Makeham's modification of the formula? Show how the latter may be used in practice to graduate a mortality table. What are the practical difficulties in its application?

4. Mention the different characteristics of the following mortality tables, and explain the effects which would result in their being used to ascertain the reserves of a life assurance society:

Northampton.
Carlisle.
Institute of Actuaries' H^M.

5. State briefly the several methods of dividing surplus. What are their respective advantages or disadvantages? Describe in what way they affect the interests of the participating policyholders?

6. Which of the methods of dividing surplus would you consider most applicable, 1st, in an office whose premiums are based on the Northampton table; and, 2nd, in an office whose premiums are based upon the H^M Table? Give reasons.

7. Define the terms:

(*a*) Estate of freehold;
(*b*) Tenant-in-tail;
(*c*) Right of dower;
(*d*) Tenant by curtesy;
(*e*) Protector of the settlement;

And give the main provisions of the Settled Land Act, 1882.

8. Compare the legal position as regards property of a woman married before 1st January, 1883, with that of a woman married on or after that date.

What are the provisions of the Married Woman's Property Act, 1882, relating to life assurance policies?

9. State briefly the provisions of the Life Assurance Companies' Act, 1870, particularly those relating to the amalgamation or transfer of life assurance companies.

10. Explain briefly the several schedules required to be periodically furnished to the Board of Trade under the Act of 1870, showing how they severally depend upon each other, and mention any alterations you think desirable in them. Give your reasons.

11. What has been the effect of the Revenue Act, 1884, in respect of paying claims under Scotch and Irish probates?

12. A policy was effected by and in the name of a married woman before 1870. In 1879 the husband became bankrupt, and the policy was assigned by his assignee in bankruptcy to a third party. The woman died in 1885, and the holder under the assignment claimed to be paid the sum assured. Can the office safely accept his discharge without further enquiry? If not, what enquiries should be made?

II.

13. In what respect does a bank note differ from an Inland Bill of Exchange? What would probably be the effect of an issue of one-pound notes?

14. In the case of an ordinary life office, describe the books you would consider necessary to be kept and the method to be adopted in order that a valuation of the office's assurance contracts might be approximately and expeditiously made.

15. In starting a new mutual life assurance company at the present time, what mortality table and rate of interest would you use in the formation of the premiums? In what securities would you recommend that the money received should be invested in the first instance, and how soon would you suggest that a valuation of its assurance contracts should be made? In the event of a surplus arising after 10 years, how would you advise that it should be apportioned?

16. State and explain briefly the several items in the accounts periodically published by the Bank of England.

17. What were the main objects of the Bank Act of 1844? What relation between notes and bullion did it establish?

18. What data would you employ if called upon to make the following investigations?

1st—Valuation of the assurance contracts of an old-established mutual life office with ample resources and still taking new business.

2nd—Valuation of the assurance contracts of a proprietary office which has ceased to take new business, and which, to prevent insolvency, had to reckon the shareholders' uncalled capital as an asset. Give reasons.

19. Give an account of the several classes of securities usually held by life assurance companies, and state which you consider the more suitable, having regard to the age, accumulated funds, and income of a society.

20. In ascertaining the amount of the assets of a life assurance company, would you set down the investments at the price of the day, or at their cost price? Give reasons.

21. A life office purchases reversions on a valuation made at 6 per-cent interest. How would you deal with these in the books, and to what account would you carry the balance on the reversion falling into possession?

22. Supposing a loan to be made upon the security of a reversionary life interest, the advance, together with the premiums, is to accumulate at compound interest for five years, and then, assuming both the borrower and the tenant-for-life to be living, fresh arrangements are to be made. For what sum and on what lives should the assurance be taken out? Give reasons.

23. In apportioning the capital of a life interest between the reversioner and the tenant-for-life, would you quote the same values in each of the following cases:

1st—When the division is by mutual consent;

2nd—When the division is at the request of the tenant-for-life; and

3rd—When the division is at the request of the reversioner.

Give reasons.

24. A is entitled absolutely to £p, subject to the following annuities and life interests:

To a life B, an annuity of £r and $\frac{1}{4}$ of the surplus income (s) arising from the investment of p.

To a life C, an annuity of £r and $\frac{1}{4}$ of s.

To a life D, an annuity of £r and $\frac{1}{4}$ of s, and to D's husband, if living after D's death, the annuity of £r to be continued.

To a life E, unmarried, an annuity of £r and $\frac{1}{4}$ of s, and in the event of E marrying and leaving a husband surviving the annuity of £r to be continued to him.

The life B is entitled for life to the above interests as they fall in, after which A succeeds absolutely.

Describe the manner in which the present value of A's interest may be obtained.

25. AB is desirous to obtain an immediate advance of £m and an annuity, paid half-yearly, of £n for ten years, provided he live so long. The advance and the annuity to be secured upon a life interest of ample value, to which AB will become entitled at the end of ten years, and to be repaid by a deferred annuity to commence at the expiration of the ten years and to continue during the remainder of the life of AB.

Show how to determine the amount of the deferred annuity, and the sum for which that annuity may be redeemed at the end of the ten years.

PROCEEDINGS OF THE INSTITUTE.—Session 1884–5.

First Ordinary Meeting, 24 *November* 1884.

The President in the Chair.

The following gentlemen were elected members of the Institute:

Fellows.

Frankland, Frederick William. | Knight, Charles Godfrey.

Associates.

Bath, John Louis.
Brownlow, William Chamberlain.
Cormack, William Alexander.
Craig, Robert Alexander.
Dawson, Charles Pearl.
Fischer, Karl Auguste Hermann.
Hazell, James Stanley.
Marks, Geoffry.
Nicoll, John.
Park, Leslie John.
Peters, Thomas Townend.
Raleigh, William Campbell.
Robinson, George Frederick.
Schooling, John Holt.
Vincent, Frederick James.
Westland, James.

The President delivered his inaugural address.

Second Ordinary Meeting, 22 *December* 1884.

The President in the Chair.

The following gentlemen were elected Associates of the Institute:

Barnes-Lawrence, Clement Henry.
Cooper, Walter George.
Forster, William Connor.
Linnell, Ernest.
Mackay, Alexander.
Moors, Elphinstone Macmahon.
Smithett, Edward Henry.
Wyatt, Sydney Herbert.

Mr. Cornelius Walford read, in abstract, the Essay upon the History of Life Assurance, which obtained the first prize awarded out of the "Samuel Brown" Prize Fund. Mr. E. A. Rusher followed with an abstract of the Essay upon the same subject, to which the second prize was awarded.

Remarks upon the Essays were made by Messrs. Adler, Harvey, Humphreys, and King.

Third Ordinary Meeting, 26 *January* 1885.

Mr. GEORGE HUMPHREYS (Vice-President) in the Chair.

The following gentlemen were elected Associates of the Institute:

Cook, John Henry. | Hemming, Arthur George.
Ledward, Archibald Prentice. | Mackie, William Cameron.
Parrott, William Robert.

Mr. James Chisholm read a paper on "The Construction of Models of Policy-Values, and on a new method of comparing the Reserves for Policies, according to different Tables of Mortality and Rates of Interest."

The following gentlemen took part in the discussion:—Messrs. Burridge, Finlaison, C. D. Higham, King, and Ryan.

Fourth Ordinary Meeting, 23 *February* 1885.

The President in the Chair.

The following gentlemen were elected Associates of the Institute:

Barton, Arthur. | Longdon, Alfred Eglesfield.
Rea, Charles Herbert Edmund.

The President read a paper on "The Probability that a Marriage entered into at any age will be Fruitful; and that, if a Marriage has been Childless for several years, it will afterwards become Fruitful."

The following gentlemen took part in the discussion:—Messrs. Adler, Bailey, Burridge, Crisford, Day, Finlaison, Ryan, Strachan, and Whittall.

Fifth Ordinary Meeting, 30 *March* 1885.

Mr. GEORGE HUMPHREYS (Vice-President) in the Chair.

The following gentlemen were elected Associates of the Institute:

Hardy, Temple. | Leveaux, Arthur Michael.
Ronald, Thomas Robert.

Mr. G. S. Crisford read a paper on "Office Premium Loadings, and how they are dealt with under the various methods of Valuation and modes of Distribution of Profits."

The following gentlemen took part in the discussion:—Messrs. Bailey, Chisholm, King, Manly, Whitcher, and the Chairman.

Sixth Ordinary Meeting, 27 *April* 1885.

Mr. M. N. ADLER (Vice-President) in the Chair.

The following gentlemen were elected Associates of the Institute:

Anderson, William Smith. | Crews, Edward Gladstone Lingham.
Gayford, Herbert Stannard.

Mr. G. F. Hardy read a paper on "The Rates of Mortality among the Natives of India, as deduced from the recent Census Returns."

The following gentlemen took part in the discussion:—Messrs. Adler, Day, Finlaison, Manly, and Ryan.

The Thirty-eighth Annual General Meeting, 6 June 1885.

Mr. George Humphreys (Vice-President) in the Chair.

Mr. H. W. Manly (hon. sec.) read the circular convening the meeting, the minutes of the ordinary meeting held in April, which were signed as correct by the President, and the following Report of the Council, and Statement of Accounts:

"The report which the Council have the pleasure to place before the members to-day, on the progress and operations of the Institute during the past session is the last annual report to be made under the old constitution and laws.

"In August of last year the Council received official information that Her Majesty the Queen had been pleased to grant to the Institute a Royal Charter of Incorporation. In accordance with the provisions of the 43rd clause of this instrument, the Council are directed to prepare draft bye-laws for the future regulation of the proceedings and affairs of the Institute. A printed copy of the draft bye-laws so prepared by the Council was sent to each member of the Institute on 26 March, with a letter inviting the delivery of observations by 15 April last. Many members responded to this invitation, and the suggestions thus received have been of material assistance to the Council in the final settlement of the draft bye-laws, which latter will, as directed by the Charter, be laid before a general meeting of the members to be held on a day between 29 August and 29 October next, and after adoption by the meeting will be submitted to the Lords of the Privy Council for their approval.

"The Charter prescribes that the President, Vice-Presidents, and Council in office at the date of its grant shall remain in office until the first general meeting to be held under its regulations; but the Treasurer, Hon. Secretaries, and Auditors, go out of office. The Council recommend the re-election of Mr. J. R. Grimes as Treasurer, and of Messrs. A. J. Finlaison and H. W. Manly, as Hon. Secretaries, for the ensuing year. Three Associates will have to be elected by the meeting to act as Auditors for the ensuing year.

"It is a great pleasure to the Council to have to report that the position of the Institute is in every respect satisfactory.

"The total number of members on the list at the close of the financial year (31 March 1885) was 430, comprising 156 Fellows, 265 Associates, and 9 corresponding members, showing an increase of 21 Fellows and 28 Associates over the numbers reported at the last annual general meeting.

"The accounts, which have been duly audited, show that the income of the year was £1,111. 6*s*. 1*d*., being an increase over last year of £57. 15*s*. 10*d*. The total expenditure was £1,355. 17*s*. 1*d*., which includes a special item of £354. 19*s*. 6*d*. incurred in connexion with the grant of the Charter. The total funds at the close of the year amounted to £3,011. 2*s*.

"The ordinary sessional meetings have been well attended. In addition to the inaugural address of the President, the following papers were read and discussed:

"*First*—The Essays by Messrs. Walford and Rusher on the 'History of Life Assurance', to which were awarded the Samuel Brown Prizes.

"*Second*—'On the Construction of Models of Policy-Values, and a new method of comparing the Reserves for Policies according to different Tables of Mortality and Rates of Interest'—by Mr. Jas. Chisholm.

"*Third*—'On the Probability that a Marriage entered into at any age will be Fruitful; and that, if a Marriage has been Childless for several years, it will afterwards become Fruitful'—by the President.

"*Fourth*—'On Office Premium Loadings, and how they are dealt with under the various methods of Valuation and modes of Distribution of Profits'—by Mr. G. S. Crisford.

"*Fifth*—'On the Rates of Mortality among the Natives of India, as deduced from the recent Census Returns'—by Mr. G. F. Hardy.

"With the termination of the session, Mr. R. P. Hardy has expressed his desire, in consequence of the state of his health, to be relieved of the duties connected with the editorship of the *Journal;* and the Council, in accepting his resignation, desire to convey to him their thanks for his services, and to express regret at the cause which has thus deprived the Institute of his valuable assistance. Pending new arrangements, the Hon. Secretaries have undertaken the duties.

"The Council are glad to report that satisfactory progress has been made in the preparation of Part II of the *Text-Book.*

"The examinations of the Institute were held on 24 and 25 April last; and the report of the examiners give the following as the result:

"PRELIMINARY EXAMINATION.

"Twenty-five gentlemen presented themselves, of whom thirteen passed, in the following order of merit:

1.—William Smith Anderson.
2.—Walter G. Cooper.
3.—Alfred E. Longdon.
4.—Arthur G. Hemming.
5.—Harry Bearman.
6.—Owen Jones.
7.—George F. Robinson.
8.—Charles S. Ayling.
9.—L. F. Hovil.
10.—Geoffry Marks, } Eq.
John T. Wingfield, }
12.—Walter G. Titmuss.
13.—Walter G. Tregaskis.

"INTERMEDIATE EXAMINATION.

"For this examination twenty gentlemen presented themselves, of whom two withdrew, and eight passed in the following order of merit:

1.—Frederick M. T. Byers, } Eq.
William R. Hopkins, }
3.—Arthur L. Dickinson.
4.—John R. Watson.
5.—William G. Turpin.
6.—Thomas Kyd.
7.—John Anderson.
8.—Frederick Schooling.

"FINAL EXAMINATION.

"Eight gentlemen presented themselves for this examination, of whom four passed in the following order of merit:

1.—Hubert Ansell, } Eq.
Stanley Day, }
3.—Henry W. Andras, } Eq.
Joseph Howard Barnes, }

"The Council have arranged to continue for another year the classes for students for the preliminary and intermediate examinations, and due notice of their commencement will be sent to the members.

INSTITUTE OF ACTUARIES.

Income and Expenditure for the Year ending 31 *March* 1885.

Dr.

1884-85.	£ s. d.	£ s. d.
Amount of Funds, 31 March 1884—		
Messenger Legacy Fund	293 13 9	
Brown Prize Fund	299 2 9	
General Fund	2,662 16 6	
		3,255 13 0
Annual Subscriptions—		
Town Fellows	277 4 0	
Country ,,	82 19 0	
Town Associates	348 12 0	
Country ,, £115. 10*s.*; Arrears, £3. 3*s.*	112 7 0	
		821 2 0
Dividends		93 13 0
Interest		2 9 1
Mortality Experience Sales		18 19 0
Text-Book, Part I, Sales		14 9 6
Journal Sales		106 17 0
Logarithm Card Sales		0 17 6
Miscellaneous Sales		0 9 0
Examination Fees		52 10 0
		£4,366 19 1

Cr.

1884-85.	£ s. d.	£ s. d.
Rent	127 10 0	
Salaries	150 5 0	
Journal Expenses and Editor	232 5 2	
Examination Expenses	58 0 8	
Brown Prizes	73 10 0	
Charter Expenses	354 19 6	
Stationery	46 5 9	
Expenses at King's College	178 4 7	
Library Expenses	3 17 6	
Ordinary Meeting Expenses	20 3 2	
Removal Expenses	62 11 3	
House Expenses	26 4 4	
Postage	17 14 4	
Miscellaneous	4 5 10	
		1,355 17 1
Amount of Funds, 31 March 1885—		
Messenger Legacy Fund	299 16 9	
Brown Prize Fund	233 8 11	
General Fund	2,477 16 4	
		3,011 2 0
		£4,366 19 1

Balance Sheet, 31 *March* 1885.

Dr.

	£ s. d.	£ s. d.
Messenger Legacy Fund (£211. 1*s.* 10*d.* Consols), cost	203 17 8	
Unappropriated Dividends	95 19 1	
		299 16 9
Brown Prize Fund, £200 Metropolitan Railway 4 per-cent Debenture Stock, cost	200 0 0	
Unappropriated Dividends, £106. 18*s.* 11*d.*; less Prizes, £73. 10*s.*	33 8 11	
		233 8 11
General Fund		2,477 16 4
		£3,011 2 0

Cr.

	£ s. d.	£ s. d.
Consols, £1,600 Stock, cost		1,498 19 3
Metropolitan Railway 4 per-cent Debenture Stock, cost		1,225 17 3
Cash at London and Westminster Bank	264 4 7	
Overpaid by Bank	0 9 0	
		263 15 7
Subscriptions in hand		8 8 0
Petty Cash in hand		6 14 11
Arrears of Subscriptions:		
Town Fellow	3 3 0	
Country Fellow	2 2 0	
Town Associate	2 2 0	
		7 7 0
		£3,011 2 0

Examined and found correct,

(Signed) H. Walsingham Andras, Geo. B. Bellamy, Chas. Windett, } *Auditors.*

27 *April* 1885.

"The CHAIRMAN, having briefly referred to the proceedings of the session, moved the adoption of the Report and Accounts; and the motion having been seconded by Mr. A. H. BAILEY, they were unanimously adopted.

"The CHAIRMAN intimated that under the provisions of the Charter the President, Vice-Presidents, and Council, had to remain in office until after the new bye-laws were framed. On this occasion, therefore, it was necessary to re-elect three officers only, namely, the Treasurer and the two Honorary Secretaries.

"These officers having been unanimously re-elected by ballot,

"Mr. L. F. HOVIL moved, and Mr. T. HARDY seconded, the election of Mr. Bellamy, Mr. Adlard, and Mr. Rusher as auditors, and the motion was agreed to.

"On the motion of Mr. T. Y. STRACHAN, seconded by Mr. C. D. HIGHAM, a cordial vote of thanks was passed to the President, Vice-Presidents, Council, and Officers, for their services during the past year; and a hearty acknowledgment of the services of the Chairman brought the proceedings to a close.

JOURNAL

OF THE

INSTITUTE OF ACTUARIES.

Opening Address by the President, THOMAS BOND SPRAGUE, M.A., F.I.A., F.R.S.E.

[Delivered 30 Nov. 1885.]

GENTLEMEN, on the present occasion I propose to submit to you a few remarks upon the business aspects of our work, and some of the circumstances on which the prosperity of a life insurance office depends. In the first instance, it may be useful to examine what is the real importance of life insurance to the country; and for this purpose I will take some of the figures which are now available by means of the returns made in pursuance of the Act of 1870, and compare them with other figures relating to the position and progress of the country. It appears from the Board of Trade returns that the income and assets of the life offices are steadily, not to say rapidly, increasing; the total income of the British life offices having increast from nearly 14½ millions sterling in 1871 to over 22 millions in 1884. The total life funds of the same companies now amount to about 140 millions, the increase of the funds since 1871 having been over 52 millions. These are very large figures, and they prove that the business in which we are engaged is a very important one. If, however, we confine our attention to them, we shall perhaps conceive an exaggerated idea of the importance of our business; and I will therefore compare them with the figures relating to some other industries. Thus I find it stated in the *Statesman's Year-Book* that the value of the total imports into

the United Kingdom in the year 1883, was nearly 427 millions sterling; and the value of the exports of British produce about 240 millions; the largest articles of import being corn and flour of the value of about 67½ millions, and the largest item of export being cotton manufactures of the value of about 76½ millions. The value of the coal raised in the year 1883 was 46 millions. The total paid-up capital of the railways of the United Kingdom was 785 millions, and the total annual receipts of the railways 71 millions. The amount of the National Debt in March 1884, was 746 millions, the annual charge in respect of it being about 29½ millions. In Professor Leone Levi's work on the *Wages and Earnings of the Working Classes,* it is stated that in 1842 Mr. Porter estimated the amount of personal property of the country at £2,200,000,000, and of real property £3,282,000,000; total, £4,582,000,000; also that in 1878 Mr. Giffen estimated the total at £8,500,000,000. In comparison with these larger figures, the funds and the business of the life offices seem small.

The population of the country is estimated to have been about 36 millions in 1884; and it would be useful if we could determine what proportion of the population have their lives insured, and whether the proportion is increasing or not. Unfortunately, the returns required to be made to the Board of Trade give very little information bearing upon these points. It has been estimated—I do not know on what basis—that the total amount of the life insurance policies in force in 1884, was about 450 millions; but I am inclined to place the figures somewhat higher, namely, at 485 millions. The total premium income of the life offices, as reported to the Board of Trade in 1884, was £15,300,000; made up of, ordinary companies £12,300,000, industrial companies £3,000,000. Perhaps 3 per-cent will be a fair average premium for the ordinary companies, and this will give total insurances of about 410 millions; and taking the average policy at £500, we get the total number of policies in ordinary companies 820,000. For the industrial companies the average rate of premium will be a good deal higher, and the average policy very much smaller. If we take 4 per-cent as the average premium, this will make the total sum assured with the industrial companies about 75 millions; and if we take the average sum assured at £10, the number of policies will be 7½ millions. The question now suggests itself whether these totals are satisfactory, having regard to the population and wealth of the country;—in other words, is it to be supposed that the practice of life insurance is as widely

adopted as can reasonably be expected, having regard to the present circumstances of the population; so that any future development in the business must arise simply from the increase in the prosperity of the population of the country? Or, may we hope to see the practice of life insurance occupy a more important position than at present, relatively to the resources of the country? My own belief is, that the results at present obtained cannot be regarded as so satisfactory that we should be content with them. The business of the life insurance companies may, I believe, be largely increast, even if there should be no further increase in the population and wealth of the country. I cannot, however, undertake to give figures in support of this opinion. Unfortunately, the course of my reading has not made me very familiar with the sources whence statistical information of this kind is to be obtained; and the time at my disposal has not permitted me to look up the necessary authorities. In order to make any satisfactory estimate on the subject, it would be desirable to compare the premiums annually paid to the companies, as above stated, with the incomes of the population, as shown by the Income Tax returns, and inferred in other ways; also, to compare the total amount of claims annually paid by the companies, nearly £12,000,000, with the total amount of the estates of the persons who die each year, as deduced from the death duties. It would have to be borne in mind also, that the figures I have given, relate to policies, and not to lives assured; and that, in order to determine the number of the latter, a very large deduction must be made because many, if not most persons, have more than one policy on their lives, either in the same or in different offices. The subject in fact, offers a wide field of enquiry; and, as I do not see any probability of my being able to enter upon it myself, I venture to express the hope that some member of the Institute, who wishes to contribute to its proceedings, and is looking out for a subject, will be led by my remarks to take up this enquiry and lay before us the results of his labours.

In pursuance of my intention of considering the business aspect of life insurance, the first question I will discuss is—In what light are we to regard a life insurance company? and the answer I propose to submit to your consideration is, that every such company is to be considered as a trading concern, and to be administered on commercial principles. It has sometimes been urged by well-intentioned writers, that life insurance must be considered by all engaged in it as a Trust; but I cannot help

thinking that, if this is the fundamental idea with which we start, it will lead us into various difficulties. My view rather is, that life insurance is a trade, and that it must be conducted on business principles. It is true there are some points in which the transactions of a Life Office resemble those of a Trust. In a trust the funds have to be carefully invested by the trustees, in terms of their trust deed, or in accordance with rules laid down by the law courts; and in the same way the funds of a life office have to be carefully invested by the directors, in the manner prescribed by the deed of partnership; and in both cases scrupulously accurate accounts must be kept of all the monetary transactions. Here, however, I think the similarity ceases. There is nothing in a trust at all analogous to the business carried on by every life insurance office. No trustees are permitted to enter into speculative transactions such as those that constitute the main business of life offices, namely, the guaranteeing of the payment of a fixed sum on the happening of an event depending on human life, which event may happen at some altogether uncertain time, or not at all. Even such transactions as the purchase of reversions, which are habitually and very properly and advantageously entered into by modern life offices, would be quite unsuitable to trusts, which, from the nature of the case, require to have a steady income, and could not be carried on if the income were an uncertain or fluctuating profit, dependent on the earlier or later death of the lives on which the reversions depend. The various processes essential to the granting of new policies, the keeping of an office in which proposals for insurance may be received from the public and enquiries answered, the medical examination of candidates for insurance, and all the other steps taken in connection with the issue of new policies, seem to me quite foreign to the idea of a trust. Still more alien from this idea is the payment of commission to agents or other persons introducing insurances; and when we contemplate the modern insurance company, of which we have now many examples, which has a head office located in a handsome and expensive building, and officered by a highly paid staff; which has also branch offices in all the important provincial towns, each with its resident secretary and clerks; and which has, perhaps, in addition, several agency inspectors, whose object is to train up an army of agents to solicit insurances from the public;—it becomes obvious that we have an organization which is wholly at variance with all ideas of

a trust. The more correct view appears to be that a life insurance company is a trading partnership, of which the directors are the managing partners. In the case of a proprietary company, the partners are the shareholders; but in the case of a mutual office, either the whole of the members or the participating members are the partners; and the rights of the partners and the powers of the directors are, or ought to be, strictly defined by the terms of the deed constituting the partnership. If now the manager of an insurance office takes up and acts on the idea that life insurance is a trust, it seems to me that this is likely to interfere—perhaps most seriously—with the success of his office. He will not be disposed to take the steps which experience shows to be necessary for the development of the business; and instead of sending out his emissaries in all directions, to convince the public of their great need of life insurance, he will be content to sit in his arm-chair and attend to the few enlightened persons who come to him to effect insurances on their lives without the usual solicitation.

As another instance of a theoretical view of life insurance which may in certain cases be misleading in practice, I may mention the doctrine that seems to be very popular at the present time, namely, that life insurance offices make no profits, and that the sums distributed by them among their policyholders as bonuses, should not be called "profits" but "surplus". This is a doctrine which I have myself never been able to sympathize with, or, indeed, fully to understand. It is quite clear, I think, that when life insurance was principally in the hands of proprietary companies, all the surplus payments made by the assured fell into the general "profits" of the companies, which were divided as dividend or bonus among the shareholders. When these companies, one after the other, agreed to give a greater or less share of their profits to the assured, the nature of the surplus was not thereby altered. If it was profit when it was paid to the shareholders, it seems to me that it still remained profit when it was paid to a certain number of the assured; in fact, the only logical position seems to me to be, that ordinary life insurance offices are trading bodies, which carry on the business of selling life insurance. Every such office, in order to protect itself against unfavourable contingencies, charges rates of premium that are calculated to be more than sufficient to meet the anticipated claims; in other words, each office sells life insurance at

rates calculated to yield a profit, and then takes stock from time to time, and divides the profits that have been earned, among the persons entitled to them according to the partnership contract. This, I consider, is equally true whether the premiums charged are high or low. In all other trades, the higher the price charged for any commodity, the larger, *cæteris paribus,* will be the rate of profit on the trading; and the same, in my opinion, is the case with life insurance. And this is true whether the office is proprietary or mutual. The only exception I would admit, is that of the few offices which do not declare a bonus out of past profits, but which make a yearly estimate of their liabilities, and on the basis of that estimate charge a reduced premium for the ensuing year, calculated so that, as far as can be foreseen, there will be no profit on that year's transactions.

Another theoretical view, which is perhaps only a development of the one last mentioned, finds expression in the opinion I have sometimes heard put forward, that it is an anomaly, if not an absurdity, for any person to effect a life policy with participation in profits; and that the more reasonable, and in every way preferable, course, is in all cases to effect a non-participating policy. However logically this conclusion may follow from the premises adopted by the persons who hold it, as to which I am scarcely in a position to speak, it must be admitted that it takes no account of the fact that the share of the surplus allotted to participating policies is, in almost all cases, of greater value and of greater advantage to the policyholders, than the difference between the participating and non-participating rates of premium. Whatever weight the above-mentioned doctrine may be entitled to carry with persons intending to insure, the manager of a life office should not allow himself to be influenced by it; and if he does adopt and act upon it, the interests of his office will be likely to suffer. It is his business to accommodate the regulations of his office to the wishes of his customers; and as there can be no doubt that the majority of these prefer to insure with profits, he will be quite right to give the greatest prominence to the regulations as to this class of insurances.

As far as I understand the doctrine I have just referred to, it seems to me to proceed upon the idea that life insurance is exclusively a contract of indemnity, the object of which is to indemnify the family of the life assured, against the loss they will suffer if he should die prematurely, and be deprived of the oppor-

tunity he might otherwise have had, of saving money and making a provision for those dependent upon him. Looking at the matter more practically, it may be held that life insurance is also a species of investment; in fact, that an ordinary life insurance policy contains elements both of indemnity and of investment. The element of indemnity is required, as just mentioned, to insure against the risks of premature death. If a man were sure that he would live to, say, 65, there would be little, if any, inducement for him to insure at all; for it would be a simple matter to calculate how much he must save and invest each year, in order to make what he considers a suitable provision for his own old age, and for the wants of those dependent upon him; but observation and experience render it certain that all men will not live to be 65, and it is impossible to say who will live and who will die prematurely. The indemnity element of life insurance is required to compensate this chance; but it has always seemed to me that this element is usefully supplemented by the investment element of life insurance, and that it may be fairly argued that a life policy is the best investment a man can make for the benefit of his family. If an indemnity only were desired, life insurance should logically cease at the age when the need for the indemnity has ceast; that is to say, when a man's working years are past, and he is no longer in a position to earn money by following his trade or profession. In fact, the logical conclusion is that all insurances should be term insurances expiring at about the age of 65. If the argument is pusht still further, it will follow that no man shall be called upon in any year to pay a larger sum than is necessary to provide the indemnity for the ensuing year, so that life insurance would resolve itself into a series of short-term insurances, each for the term of one year, the premium of course increasing with the increasing age of the life. Such a plan is, I believe, actually in use in America, and seems to me to be natural result of giving undue prominence to the indemnity element in life insurance, and neglecting the investment element. This plan is only likely to be popular with those persons who wish to pay at the outset the smallest possible sum, and are satisfied that they can make better use of their money than an insurance office is likely to do; but in this country, whatever theorists may say, the investment element is popular; and I trust that I may be allowed to add that, in my opinion, it is deservedly popular. Persons who insure their lives are not only willing to pay the higher whole-term premium, but they are willing to pay the still higher rate for a participating

policy, instead of the lower rate of premium for a policy without participation in profits, because they have a well-grounded belief that the additional payment will be a good investment, for the reason mentioned above. The conception of a life insurance policy as a contract which combines indemnity with investment, seems to reach its highest development when the premiums are payable only for a limited term of years, say up to the same age as we have already mentioned, 65, when the need for indemnity may generally be expected to cease; that is to say, when the earnings of the assured will generally be reduced, or altogether cease; when those formerly dependent upon him will be earning their own living, or be otherwise provided for, or have died off. When, for these or other reasons, the need of an indemnity is no longer felt, then, according to the view I have been endeavouring to lay before you, life insurance ceases to be a desirable investment. Consistently with the condition that the payment of premiums shall cease at the age of 65, the policy may either be an endowment assurance payable at that age or on previous death, or it may be a whole-life policy, subject to premiums that cease at that age; the insured selecting the one form of policy, if he anticipates that he will not be able in other ways to accumulate a sufficient provision for his old age; and the other form, if he feels sure he can provide for himself, and only wishes to make a certain provision for those who come after him.

America, which has already furnisht us with an instance of a policy in which the indemnity idea has been carried to an extreme, furnishes us also with examples of the investment idea being carried to an extreme, namely, in the Tontine policies of which we have heard so much during recent years. I am inclined to think that this subject has called forth some unnecessary warmth of feeling. The tontine principle, as a matter of fact, enters largely into the ordinary arrangements of most British life offices; for example, when it is provided by the regulations of an office that a policyholder shall not be entitled to a surrender value until he has paid three years' premiums, and shall not be entitled to the benefit of a bonus until his policy has been five years in force. It would, I think, be inconsistent for offices which have regulations of this kind, to make objections to the tontine principle. When that principle is carried so far that tontine policyholders shall receive neither bonus nor surrender value until after their policies have attained a certain age, say 15 or 20 years, it seems to me that this is simply carrying to an extreme, the investment element of life

insurance. The persons who take out policies of this kind, are those who have a firm belief in their own ability to continue paying the premiums for the stipulated term; and they enter into the contract, because they hope to secure a certain provision for their family if they should die within the term, and a good investment for themselves if they should survive it. Looking at the matter commercially, it seems to me that companies which make the grant of tontine policies a special feature, need not be regarded as dangerous competitors by offices transacting ordinary life insurance; for I think it probable that persons are led to effect tontine policies who would be unlikely to effect policies of the ordinary kind. In a word, I am inclined to think that the result of the competition of the American offices in this country, has been to increase the total amount of life insurances effected,—that they have, to a great extent, created the business which they transact; so that the greater part of the insurances which they issue, would not have been effected with other comanies; and that their effect in withdrawing custom from the British offices, has been comparatively small.

I believe that competition is a good thing for all parties, that the more life offices there are working in the field, the larger will be the total amount of life insurance policies effected, more especially if the offices do not all proceed upon precisely the same plans, but offer some material differences in their principles and practice. Hence, I am not only content to see the American offices at work among us, with every prospect of remaining here permanently, but I should welcome some of the large Australian offices if they saw their way to open agencies in this country for the transaction of ordinary life insurance business. The intercourse between Great Britain and its colonies is every year growing more frequent and intimate. In one respect, the British offices may be said to be encroaching on the territory of the Australian offices; for they are learning how to invest their money in the colonies; and this business seems likely to attain large dimensions if it is not driven away by unwise legislation on the part of the colonies. I find from White's *Insurance Register* for 1885 that the Mortgages on Property out of the United Kingdom, most of these being probably on colonial securities, increast from £1,225,000 in 1881 to £1,578,000 in 1884; and quite recently it has been announced that one of our largest offices is sending out an experienced official to Australia, to represent them there in

the matter of investments,—presumably with instructions to invest some of their millions upon good Australian securities.

The foregoing remarks indicate various ways in which ideas as to our business which are based on an erroneous theory, may mislead us in practice; and they may serve to suggest that we should be slow to accept and act upon the conclusions of theory, unless they are confirmed by what may be called either educated common sense or the teachings of experience. In order to guide ourselves aright, we must, I think, remember that, although our business is built on a scientific basis, yet the institutions we advise, and in whose welfare we are interested, must be conducted on commercial principles. Whenever, therefore, we find that the conclusions of theory cannot be reconciled with those suggested by our business experience, then, however apparently conclusive the reasoning may be, the theoretical conclusions should be distrusted and most keenly scrutinized; and it will not unfrequently be found that the theory we have proceeded upon, is imperfect, and has failed to take account of some important practical consideration. As an instance of this, I may mention the doctrine that has been put forth in some quarters that a member of a mutual insurance office ought to be at liberty at any time to withdraw his whole stake in the concern; by this being meant the full reserve that is made by the office for meeting its liability under his policy. When we test this doctrine by common sense, we have no difficulty in seeing that it might lead to disastrous results. It assumes, like the imperfect theory on which it is based, that all the lives assured are in the same average state of health; whereas the fact is, that some of them may be at the point of death, and others suffering from acute diseases which will soon kill them, and others from chronic diseases which will inevitably shorten their lives. If, then, the lives remaining in good health were allowed to act upon this doctrine, and to withdraw the full estimated values of their policies, which, according to the usual British practice, is the reserve made in respect of them, it is clear that the remaining fund would be wholly insufficient to meet the liabilities upon the damaged lives, who alone, according to the supposition, would remain insured. The case is, of course, materially altered if the office has in hand, in addition to the full estimated reserve for its policy liabilities, a large reserve fund accumulated out of undivided profit, as seems to be usually the case with the American offices. Another deduction, of an opposite kind, from the same incorrect theory, is that the surrender value to be given to a

retiring policyholder, should never exceed the estimated liability under his policy, or the reserve made in respect of it. If, however, a life assured, in the last stage of a lingering illness, applies for an increast surrender value, it will evidently be to the advantage of the office to make special terms with him, and to pay a surrender value, not only much larger than would be ordinarily paid, but greatly in excess of the theoretical reserve made for the policy. The true explanation of this want of harmony between the the conclusions of theory and those of common sense, is, as suggested above, that the theory is imperfect, inasmuch as it assumes that all persons of the same age, are in the same state of health and subject to the same rate of mortality. Every step that is taken in improving the theory of life insurance, will have the effect of removing some anomalies of this kind; and already considerable progress has been made in this direction. I trust I may be excused if in this connection I mention the labours of our honoured Fellow, Mr. J. A. Higham, and those of the late Mr. Spens. The subject seems to me not to have received the attention which its importance demands; but in saying this I am making no confession of a default on my own part, for, as you are all aware, in my paper upon the "Select-Mortality Tables" which I submitted to the Institute a few years ago, I claim to have given actuaries a means of obtaining approximately true answers to questions of the kind discust above. It has been a source of great satisfaction to me, to see that the line of investigation I there indicated, has been successfully followed up in the case of the Government annuitants, by a gentleman who will perhaps allow me to call him, with every feeling of respect, the Hereditary Government Actuary.

The same blind adherence to an imperfect theory, has led some authorities to insist upon applying the same valuation rules to all companies alike, irrespective of their special circumstances. The theoretical expression for the value of a policy, takes no account of the expenses of management; and in adopting this formula as the basis of the valuation of a company, it is assumed that the expenses are in every case less than the uniform loading added to the uniform annual net premium. This is an assumption, however, which is not justified by the facts, both as regards the total business of most young companies, and as regards the new business of most old companies. It is therefore necessary, in order to get an appropriate formula, to introduce into our calculations the amount of expense at which the new business is

obtained; and thus, for old and young companies alike, we conclude that the proper reserve to be made for the liabilities is less than that given by the ordinary net-premium method of valuation. Those writers who have undertaken to defend the net-premium method of valuation as the proper one to be applied in all cases, have found themselves forced to admit that, in the case of young companies, a smaller reserve is quite consistent not only with solvency but with prosperity. In order to get over this difficulty, they have argued that in such companies we may, in regard to the special circumstances, make a smaller reserve than is theoretically necessary. The more correct view appears to me to be, that those companies which make their valuations by the net-premium method of valuation, make a larger reserve than is theoretically necessary; in fact, that they set up a reserve fund, which, although concealed from view, is none the less real. This method of procedure may be regarded as erring on the safe side, and therefore unobjectionable; but it has the inconvenience that, in calculating the surrender values of policies, and in reasoning as to the rights of policyholders, if the larger reserve given by the net-premium method is taken as the basis of our calculations, instead of the smaller one which is obtained by making proper allowance for the expense of obtaining new business, we shall often be led to erroneous conclusions.

Perhaps I may also venture to cite as another instance of the same kind, the doctrine very strongly held in some quarters that the cash bonuses declared upon the same policy at successive divisions of profits, should, *cæteris paribus*, be approximately constant, and that the reversionary bonuses should therefore form a diminishing series. This is, I believe, not a popular doctrine with the public, and it seems contrary to the suggestions of common sense, which would lead us to believe that, the longer a policy remains in force, the larger in proportion to the time must be its contributions to the profit fund, and that therefore the bonuses allotted to it should form an increasing series. This common-sense view is found upon examination to be supported by theory, when we introduce certain conditions which are neglected by the imperfect theory on which the above-mentioned doctrine is based.

As a last instance of the way in which, in my opinion, too rigid an adherence to an imperfect theory may lead us astray, I take the graduation of mortality tables. All attempts hitherto made to express the law of mortality by a mathematical formula,

have had only partial success; and I think I may say, without fear of contradiction, that no formula that has yet been proposed, has been found entirely satisfactory. It is therefore, in my opinion, unwise to attempt to force a set of observations on mortality experience into conformity with any assumed law, such, for instance, as Gompertz's, which, although satisfactory enough for long periods, is not satisfactory throughout the whole of life. It is also a mistake to adopt any mechanical method of averages, or to use a formula by which the irregular facts given by observation are rendered less irregular by substituting for each one a new value obtained from a larger or smaller number of the adjoining values. I hope to show on some future occasion, that any method of this sort virtually assumes that the law which the observations follow, is of a particular kind; and from this it results that, if the method be applied to a series of figures following that particular law, it will leave them unaltered; whereas, if it be applied to a series that follows any other law, it will alter the progression more or less; in fact, it will introduce an error into the series. If we assume, as seems reasonable, that the rate of human mortality follows a certain law, which would be represented by a regular curve if we could only ascertain what the law is, our present position is that we do not yet know what is the nature of that curve. It is therefore unwise to attempt to force our facts into correspondence with some known curve, which is certainly not the correct one; and the better course is to adopt the graphic mode of graduation, which is the outcome of educated common sense. According to this, we allow the facts to speak for themselves and indicate their own law, and we then draw a curve which represents approximately the observed facts, and afterwards correct it until we obtain a sufficient accordance between it and the facts.

In making these remarks I do not wish to undervalue the teachings of theory, but only to warn you against too exclusive a reliance upon them. I consider that theory is a most useful assistant, but not a guide to which we should trust ourselves blindfold. We must, on the contrary, always be on the watch to see whither it is leading us; and we should refuse to follow it when it is bringing us to conclusions that do not commend themselves to our educated common sense. I would therefore caution the actuary against being too much a man of theory, and would urge him to take every possible opportunity of testing his theoretical conclusions by the teachings of experience. If our companies are to be successful, the theoretical advice of the pure

actuary (or the man of science), must always, before they are acted upon, be carefully scrutinized by the man of business from a practical point of view. It should therefore be the aim of every actuary to combine these different qualifications in himself; in other words, he should aim at being both a skilled actuary and an experienced man of business, so that he may be able to apply his mathematical knowledge to solve any new problem that may present itself in the course of his business, and then to submit the theoretical result given by his formulas to a searching scrutiny in the light of his business experience.

Passing on now to consider what the success of a life office depends upon, it will be seen from what I have said that I am of opinion that, in order for the management of a life office to be successful, it should be conducted on purely commercial principles. A life insurance office is not a benevolent or a charitable institution. Occasionally we see Directors act as if they thought the society under their charge, partook of this character. For instance, in times of public excitement Directors of offices have voted sums for the relief of exceptional distress; but it seems to me that any such appropriation of a life insurance company's funds is of doubtful legality and might successfully be challenged by any person interested in the company. Again, Directors are sometimes disposed to deal more leniently with a poor policyholder than with a rich one. This also seems to me to be quite contrary to sound principle; and I hold that the poorer persons interested in a company should be dealt with on exactly the same principles as the rich. Such concessions, for instance, as making payment of a small sum assured immediately on proof of death being furnisht, while payment is delayed several months when the sum is larger, cannot, I think, be defended on business principles; in fact, I would lay down the principle that those who wish to be charitable, should do it at their own expense, and not at the expense of the partnership funds they have to administer. Nor should a life office claim to be a philanthropic institution, founded to promote the growth of provident habits among the people. This may very probably, let us hope, be one result of the operations of the life offices; but it is not their object, and it would be unwise to base their claims for public support on a ground of this kind.

I will now consider some other points on which the success of a life office depends. In order to treat this subject exhaustively, it would, of course, be necessary to define precisely what is to be understood by the success of a life office. This would, however,

be too wide a subject for me to enter upon to-night, and I will therefore content myself with saying that no life office can be considered to be successful, unless the annual waste of the membership by deaths and secessions, is fully supplied by the new business. It is not sufficient that the amount of the funds should increase, but the total sum assured and the premium income should either increase, or, at all events, be permanently maintained; or, to speak more precisely, in every office of (say) less than 60 years' standing, the premium income and the sums assured should be increasing, and in older offices should be at least maintained; and any life office which does not satisfy this condition, must be held to be lacking in one of the essential marks of success. It is therefore essential for every office to secure a constant accession of new business, and for this purpose it must take measures to attract customers; and here again the same principle may guide us which I have already laid down, namely, that a life insurance office must be considered a commercial undertaking, and must be managed upon commercial principles. It does not follow that all offices should take the same steps to attract new business. For life insurance offices the same principles hold good as for other commercial undertakings. It may be said that there are two principal means by which traders can get business—by advertising and by the employment of travellers. For some businesses, where it is desirable to appeal direct to the public, advertising is the preferable course; but where the public are not approacht directly, but through the medium of middlemen, such as shopkeepers, it may be a simple loss of money to spend it upon advertisements, and the employment of travellers may be really the only suitable means for obtaining custom. The same seems to me to hold good with regard to life insurance. Some companies are, from special circumstances, able to approach their public direct, and in fact do receive a great part of their business in proposals made over the counter, without any introduction that can be traced. For such companies, advertising is useful; but when a company obtains the bulk of its business from its paid agents, whether they are paid by salary or commission, it is probable that advertising is of very little advantage. Some traders are in the happy position of getting most of their business with very little exertion from a connection already establisht, and the same is probably the case with a number of life offices, as, for instance, when the bulk of the business is introduced by the directors; but there is a constant tendency in a business obtained in this

way to shrink, as the supporters of the office either die, or grow old and take less interest in business matters. It is therefore, I think, certain that no office which trusts to its connection, can hope to be permanently successful; but every office must take active steps to make good from new sources the loss that it sustains in the manner just described. It must not be forgotten that in certain circumstances the two methods of obtaining business which I have mentioned may be inconsistent with each other. If, for instance, a trader relies principally upon the exertions of his travellers, and they are paid principally in proportion to the amount of business they introduce, it will scarcely be fair towards them to receive business direct from the public and give the traveller no benefit from the business that may probably be more or less due to his exertions; while, if the traveller's remuneration is so arranged that he derives a benefit from the whole of the business from a certain district, whether directly introduced by him or not, the office, if it advertises to any large extent, will be paying twice over for its business. In connection with this matter it must not be forgotten that life insurance is not a commodity which all persons feel the need of;—that, in fact, most persons do not insure until they are solicited by some friend, who represents, or is interested in, a particular office; and that, under these circumstances, they are not likely to read advertisements for the purpose of seeing which office offers the greatest advantages. So far as these considerations prevail, I am inclined to think that money spent upon advertisements is almost thrown away, and that it is better for an office to rely upon its agents. These considerations must, however, not be pusht too far. I believe that experience shows that, in populous places like London, there are a large number of prosperous professional and commercial men, who certainly should be candidates for insurance, but who are not accessible to the solicitations of an agent in the same way as persons who stand somewhat lower in the social scale. In order to reach such persons, it will be necessary to advertise in some way, and it becomes a matter of careful study what form of advertisement is most likely to come under their notice.

In the long run, I believe that the conditions of assurance will have a material effect in determining the success of an office; but the operation of this will be gradual and slow. When a man proposes to insure his life, it is, I believe, rare for him to scrutinize carefully the conditions of assurance. For example, he would very

rarely think of asking, "What surrender value will you return to me if I wish to withdraw after a certain number of years?" or, "How will you deal with me if I wish to go abroad, or if I omit to pay my premium within the stipulated time?" But, when one of these cases has happened, he will form a favourable opinion (or the contrary) of his company, according as he believes himself to have been fairly or harshly treated. Again, if a man whose life has been insured for (say) thirty years, commits suicide under the pressure of money or other troubles, the public sentiment will approve of the payment of the policy money to his innocent family; and if the company declares the policy void, the opinion will be held that, although they may have been within their legal rights, they have acted very harshly; and in this way a favourable or unfavourable opinion, as the case may be, will get abroad about the company, which cannot fail to have some influence upon its prosperity. It seems to me the object of the manager should be to ascertain what conditions public sentiment will generally approve as just and fair; and I believe that foremost among these may be placed the non-forfeiture regulations which are now being adopted by so many offices. The public will rightly hold that it is very harsh and inequitable that a policy which has been in force for many years, and has acquired a large surrender value, should be altogether forfeited by failure to pay the stipulated premium within the days of grace; and the managers of offices therefore, in my opinion, act wisely in devising methods that will, to a greater or less extent, remove this hardship. Some of our friends are perhaps going too far, as when they virtually give a full year's insurance for a quarter of a year's premium; or when they charge no fine (or fee) on the revival of a policy, so that the office gets no equivalent for the additional correspondence and trouble that is occasioned by the default of the assured; but the general move in the direction of liberalizing the conditions of insurance, is one upon which, I think, both the offices and the public are to be congratulated; and I do not doubt that it will have the effect of rendering life insurance more popular, and increasing the business of the offices. As an instance of the manner in which the conditions of assurance have an effect on the business of an office, I may mention the early payment of claims. When a young man comes to receive the sum payable under his father's policy, this should be a very suitable opportunity for endeavouring to obtain an insurance proposal from him. If, however, the son finds that his father had policies in

several offices, that one pays immediately after the claim certificates are sent in, that another delays for three months, while a third perhaps does not pay until six months after the death has occurred, he is very unlikely, if he effects an insurance on his own life, to give it to the office which delays the payment for what must appear to him an unnecessary time.

I have placed first among the conditions of success, the obtaining of a sufficient amount of new business; for I regard this as the most indispensable condition. But when the business has been obtained, and the company is growing old, many important questions will from time to time arise, which will require most careful consideration by the actuary; and the decision upon which may have a most important bearing on the success and permanent prosperity of the office. For instance, there will be questions as to the internal arrangements of the office, which require to be judiciously dealt with, so as to secure the smooth working of the machinery. Consistently with what I have already said, I believe that the same principles are applicable here as in the case of other commercial institutions. The same or similar questions will arise naturally in every large institution, as to the remuneration of the staff and the promotion of certain members of it; and they must be dealt with upon broad and fixt principles, laid down, not only with regard to the present, but also with a view to their probable working in the future. The fundamental object, of course, must be to obtain an efficient staff who are interested in their work, and to pay this staff at the least possible expense, consistently with its being thoroughly efficient. These are exactly the sort of questions that have to be considered by the Statesman in considering as to the remuneration of the servants of the State, both civil and military; and they have to be decided upon similar principles. In considering these questions, a broad distinction must be drawn between those officials whom it is considered very desirable, or even essential, to retain in the service of the office, and those who could be replaced without difficulty, either by inviting applications from outsiders, who have had no special experience, or by promoting juniors. The principal considerations to be kept in view are threefold. In the first place, it is desirable that all the officials of a large and wealthy company, should have such remuneration that they may be able to live in comfort; and it would be very false economy to reduce the salaries to such a point that any members of the staff should feel themselves placed at a disadvantage as regards other persons in their

own rank of life or in similar employment. The other considerations which bear upon the question are (secondly), what salary could any member of the staff obtain elsewhere if he left the service of the company? and (thirdly), what would it cost the company to replace him? When an official is a man of experience and of more than average ability, it may be thought very desirable to retain his services, because it would cause inconvenience and additional expense to part with him. For instance, it may be clear that there is no junior member of the staff who could be promoted to take his place, and that therefore, if he left the service of the company, it would be necessary to invite the services of an experienced official from some other company; and in this case it is clear that the salary to be paid must be at least as much as the official could probably obtain in another company. But, if the official, although discharging his duties satisfactorily, could be easily replaced, then the question what he could obtain by leaving the service of the company, becomes immaterial. In fact, the company can then take up the position—"You are perfectly at liberty to leave our service if you think you can better yourself elsewhere"; and the salary has then to be adjusted simply with regard to the other two considerations.

The regulations as to promotion are also very important. The conclusion at which I have arrived as the result of my observation and thought, is that the worst of all possible systems is simple promotion by seniority. It is, I believe, essential to the welfare of every large and important institution, that the principal officers should attain their position before they are too old; that they should be promoted to positions of increast responsibility while they are in the prime of life, with their vigour and energies unexhausted. Under a strict system of promotion by seniority, this is not possible; and I therefore believe that promotion should always be made by selection. Of course, the selection should be made, where possible, according to merit; and any arrangement that will give juniors an opportunity of distinguishing themselves beyond their fellows, is therefore to be encouraged. For this reason it is desirable to encourage junior clerks in a life office to become members of the Institute of Actuaries, and to hold out to them the prospect of an increase of salary upon their passing the examinations. It may be that in some departments of the work promotion by merit is not found practicable, that for the work required to be done, (as I have seen it stated with regard to Officers in the Army,) one man

is just as good as another. In this case I would say that promotion must still be by selection. However invidious the task may be, those who are responsible for the welfare of the institution, must make a selection; and, in making this selection, I think that, in default of more important distinctions, they may very properly be guided by personal and social considerations, and that promotion, even on this plan, will work better than promotion by simple seniority.

I have said that the remuneration and promotion of the staff should be regulated by broad and fixt principles. The same should, I think, be the case as regards other classes of persons with which the office has dealings, as, for instance, the agents and the public. The rates of premium at which insurances are granted, as stated in the publisht prospectus, should be strictly adhered to, and any suggestion that a lower rate may be accepted in a particular case, because a rival office charges less, should be firmly resisted. So also the rates of commission to agents, as stated in the agents' instructions, should be similarly adhered to, and not increast in individual cases because a rival office has offered a higher rate. Again, as regards the conditions of assurance, if it is thought just to relax any of these upon special application, as, for instance, to provide that a policy in the hands of third parties shall not be void in consequence of the life assured going beyond the stipulated limits without their knowledge, then a similar protection should be given also to other policyholders who have not thought of applying for it. This branch of my subject may be summed up by saying that a life insurance company should not be squeezable. If the rules and conditions of the office are such as commend themselves by their fairness, then I hold that the public will think none the worse of the office if those rules and conditions are strictly adhered to.

In conclusion, I feel some explanation is due to you for the course I have taken in introducing into my address a number of controverted subjects. I think my best apology for this course will be the statement that I have myself in former years derived great benefit from listening to the opinions exprest by my seniors in the profession; and that, even in cases where I did not at the time see my way to agree with those opinions, and have since come to entirely contrary conclusions. This leads me to believe that it is an advantage to the junior members of a profession that the head of it for the time being, should state the opinion he has formed upon

the various questions that have recently come up for discussion, and the reflections and conclusions that have been suggested by his experience. The value of these opinions and reflections will be to a great extent independent of their truth. Even when they are most questionable, they are still of value, as stimulating thought in others; but when a man of experience, who has not been content simply to adopt the current opinions, but has independence enough to form opinions for himself, and, if necessary, the courage to give free expression to them,—when such a man states the conclusions at which he has arrived, I believe it will always be found that, even when his opinions may seem most questionable, there will be elements of truth in them. In all controverted matters, truth is best arrived at when each of the opposing views is supported by its own adherents and advocates; and in many such matters time is an essential element in coming to a correct conclusion. The persons who have taken part in a heated discussion, are very rarely qualified to be impartial judges of its merits; and sometimes it is necessary to leave the decision to a new generation, who shall grow up without the prejudices of their predecessors, and who will thus be better able to recognize how much of truth there is in each of the conflicting views, and to form a final judgment, which may perhaps be essentially different from either of the original ones. In making these remarks, I have kept in view the fact that there is never any public discussion on the president's address, also that it would be in every way undesirable that a future president should criticize and discuss the address of one of his predecessors. There is, however, no objection to his taking the opposite view of any questions that have been discust, and stating his own conclusions and the arguments in their favour. The discussions at this Institute have, I think, always been distinguisht by the freedom with which opposing views have been stated and advocated by the members. As I have already mentioned, I believe that, in this way the object which we all have at heart, namely, the search after truth, is best promoted; and I shall be gratified if time proves that the reflections I have put before you to-day, are a contribution to this object.

On the Income Tax, especially in reference to its Incidence on Assurance Companies. *By* ARTHUR HUTCHESON BAILEY, F.I.A., F.S.S., *Actuary to the London Assurance Corporation.*

[Read before the Institute, 21 Dec. 1885.]

IN an article on Life Assurance that appeared in the *Economist* some time ago, the following passage occurs :—" We should be " all the more sanguine of future success if the purely actuarial " element were given somewhat less prominence and power in the " direction of the offices. The fact that they (*i.e.*, the actuaries) " are immersed in mathematical abstractions is calculated to " impair their efficiency as men of business. They are not " brought sufficiently in contact with the public to know and " appreciate their wants, or to discover the best means of satis- " fying them. They are men of the study rather than of the " market place."

This is, probably, a not uncommon, but, as I believe, an entirely erroneous conception of the functions of actuaries. True it is, that without mathematical knowledge they cannot become masters of the subjects with which they are concerned. Those subjects, however, are not " mathematical abstractions ", but problems of practical finance; and, therefore, on a former occasion I ventured to say, that the proper definition of an actuary was a scientific financier. Certain, it is, that actuaries must be men of business, or they will signally fail in their profession. What I contend for is, that they need not be worse, and ought to be better, men of the market place, because they have been, and should continue to be, men of the study also.

In illustration of this contention, I propose to ask your attention to a subject which is certainly no mathematical abstraction, but one that comes home to our business and bosoms—the Income Tax.

The subject is not a new one here. The early volumes of our *Journal* contain contributions upon it from the late Mr. Jellicoe, the late Mr. Peter Hardy, and Mr. Hill Williams. It has been discussed at sessional meetings; a modification of the tax, under the name of the actuaries' plan, was submitted to a Committee of the House of Commons, before which members of this Institute gave evidence, and the plan itself was examined in some detail in the Budget speech of the Chancellor of the Exchequer in 1853.

Proceedings have lately been taken in the Courts of Law, at the instance of the revenue authorities, to decide some questions that had arisen in levying the tax upon assurance companies. As these proceedings have attracted some attention, as it is not unlikely that they may lead to some changes in the law, and as some of the questions involved are not free from difficulty, it has occurred to me that the attention of the Institute might again be directed to the whole subject.

Before discussing the incidence of the tax on assurance companies, which is the main object of this paper, it may not be out of place to give a short history of the tax itself. In doing so, I shall endeavour to steer clear of party politics, which ought not to be difficult, as both the great political parties in the State are committed to the impost.

The origin of the income tax dates back to the end of the last century.

During the height of the war with the first Napoleon, in the year succeeding that which had witnessed the mutiny of the fleet at the Nore, the suspension of specie payments by the Bank of England, and the fall in the price of Consols to 47½, the Act of Parliament, 38 Geo. III, cap. 16, became law on 12 January 1798. This Act, entitled "An Act for granting to His "Majesty an aid and contribution for the prosecution of the "war", imposed upon all payers of assessed taxes an increased duty, varying from one-fourth of to five times the amount of their last assessment, and allowing, at the same time, deductions, varying according to the amount of each income, so that the increased duty should in no case exceed one-tenth of the income. The produce of this tax was £1,855,000, a result evidently disappointing, as in less than a year the Act was repealed by the 39 Geo. III, cap. 13, which became law on 9 January 1799. This Act, entitled "An Act to repeal the duties imposed "by the Act for granting an aid and contribution for the prosecu-"tion of the war, and to make more effectual provision for the "like purpose by granting certain duties upon income in lieu "of the said duties", was the first Income Tax Act proper. The preamble recites, "That the provisions of the Act of last "Session had in sundry instances been greatly evaded, and that "many persons are not assessed under the said Act in a just "proportion to their means". To remedy this, every one was required to make a return, in a prescribed form, of his income

from all sources, and a tax was levied upon the incomes at the following rates, namely,

Under £60 per annum, exempt;
£60 to £65, $\frac{1}{120}$th part, or 2*d.* in the pound;
£65 to £70, $\frac{1}{95}$th part;

and so on; the rate varying with every increase of £5 in income up to £200, when the rate was 2*s.* in the pound, or 10 per-cent. Deductions were allowed of 5 per-cent for every child of the tax-payer, if the income were less than £400 per annum. For incomes above that amount the deduction varied according as the children were over or under six years of age, and the rate of deduction diminished as the income increased; a man whose income was £5,000 a-year, or upwards, being allowed a deduction of 2 per-cent only for each child above the age of six, and 1 per-cent for each child under that age. So that the Act seems to have instituted a minute enquiry into the domestic, as well as pecuniary circumstances of every subject. It was, of course, very unpopular, and so unsatisfactory in its operation, that while the tax was expected to yield £10,000,000, its actual produce was £6,046,000 only. After four years' experience, an important change was effected by the Act of the 43 Geo. III, cap. 122, which became law on 11 August 1803, and is substantially the law as it now exists. By this Act the principle was introduced of taxing the income at its source in all possible cases. For this purpose, incomes from different sources were classified under different schedules, namely,

A.—Land and houses.
B.—Occupation of land.
C.—Public funds.
D.—Trades, professions, and incomes not assessable under other schedules.
E.—Salaries.

The Act reduced the rate of tax from 10 to 5 per-cent; but, notwithstanding this reduction by one-half, the tax produced in 1805 £4,496,000, about three-fourths of the produce under the former method of levy.

In 1805, the rate was increased to $6\frac{1}{4}$ per-cent, and again increased in the following year to 10 per-cent. The yield of the tax in the year 1808 was £11,398,000, and increased year by year up to 1815, when the produce was £15,227,000.

The Act declared that the income tax was to be enforced "for "and during the continuance of the war, and no longer". Peace was established in 1815. But, at the beginning of 1816, the Chancellor of the Exchequer announced his intention of proposing to continue the tax upon the modified scale of 5 per-cent. This announcement produced a great sensation. Petitions against the tax poured in from all parts of the country; and the battle in the House of Commons, which seems to have been a remarkable example of Parliamentary strategy, ended on 17 March by the defeat of the Government by a majority of 37, with a remark by Wilberforce that, "the wholesome principle was laid down that war and income tax are wedded together".

For 26 years the tax was buried. But, in 1842, in a time of increasing embarrassment in the finances of the country, the late Sir Robert Peel called forth from repose, to use his own words, "this giant, who had once sheltered us in war, to come and assist "our industrious toils in peace". The Act of Geo. III was revived, the tax being at the rate of 7*d.* in the pound, or £2. 18*s.* 4*d.* per-cent; incomes under £150 per annum being exempt. A remark of De Morgan may be worth a passing notice here. He said, that this rate was an instance of the ignorance among our great financiers of decimal arithmetic. The obvious intention was, that the rate should be 3 per-cent. But 1*s.* 8*d.* per-cent was sacrificed, in the belief that it would be easier to calculate 7*d.* in the pound than it would be to calculate 3 per-cent. Every one here knows that the reverse is the case, and that the calculation of income tax is somewhat troublesome when the rate is 7*d.* or 5*d.* in the pound.

For eleven years no change was made. The produce was £5,405,000 in 1843 and £5,667,000 in 1853, varying but little in the intervening years. In 1853 the tax was, for the first time, extended to Ireland; the limit of exemption being altered from incomes of £150 to those of £100 per annum; the duty on these minor incomes being at the lower rate of 5*d.* in the pound. And an allowance was granted in respect of the annual premiums paid for life assurance, such allowance not to exceed one-sixth of the duty assessable. In the course of this year the Crimean war broke out, an event which disturbed all the financial arrangements. The rate of the income tax was doubled, and from that time to the present the tax has continued to be levied, but the rates have varied according to the exigencies of the State, from a maximum of 1*s.* 4*d.* in the pound in 1856 to a minimum of 2*d.* in

the pound in 1875. The exemptions of the smaller incomes have from time to time been extended. Thus, in 1863 the rate of duty was made uniform, but an abatement of £60 from incomes between £100 and £200 was allowed. In 1873 this abatement was altered to £80, and the incomes to which it applied were extended to £300. Finally, in 1876, incomes under £150 were totally exempted; the abatement was altered to £120, and made applicable to all incomes under £400. The produce of the tax at 5*d.* in the pound for the year 1884 was £10,718,000.

The mode in which this tax is assessed has been the subject of, apparently, endless controversy. At least two select committees of the House of Commons have been appointed; one, in 1852, on the motion of the late Mr. Hume; the other, in 1861, on the motion of Mr. Hubbard, to enquire whether any more equitable mode of assessing the tax could be adopted. The answers have been in the negative. Evidence was given before these committees by men of high authority in economic science. Generally, these authorities agreed to adopt the dictum of Adam Smith that, "the "subjects of every State ought to contribute towards the support "of the Government as nearly as possible in proportion to their "respective abilities; that is, in proportion to the revenue which "they respectively enjoy under the protection of the State". But, upon the question how the respective abilities were to be determined, all agreement ceased. To specify in detail these various opinions, would extend this communication beyond reasonable limits. I must content myself, therefore, by making an extract from an able paper by Mr. W. L. Sargant, which expresses, in forcible language, the impression left on his mind by a perusal of the evidence given before Mr. Hubbard's Committee. Mr. Sargant says, "I found one authority stating, that a man ought "to be taxed in proportion to the income which he can afford to "spend; and that, as the income tax is only temporary, its "incidence ought to be nearly *the same* as that of indirect "imposts. I found another stating, that the income tax ought "to be regarded as permanent; and that, among many other "advantages, it possessed this eminent one—that its incidence "was quite *different* from that of indirect imposts, since it took "toll from those fortunate men, who, with large incomes and "few wants contributed little to taxes on expenditure. I found "a third stating, that men should pay in proportion to their "ability; that that ability should be estimated, not according to "present income, but according to property possessed—property,

" however, being taken to mean, not merely land, houses, funds, " and other *external* objects, but also skill, abilities, and every- " thing else *inherent* in the tax-payer; besides that, every income " should be regarded as an annuity, and should be taxed according " to its present capitalized value. A fourth told me, that savings " ought not to be taxed, because, when invested, they yield an " income which is afterwards subject to assessment; further, " that justice requires each individual to pay, not an equal " proportion of his income, but such a sum as shall, in every " case, entail an equal sacrifice. Other opinions I find expressed, " that capital should not be taxed in passing from hand to hand; " that savings are capital, and should, therefore, be exempted; " that professional education, and waiting for practice, are virtually " capital, and give a claim to exemption; that the tax gatherer " should go to *persons,* not *things;* that he should go to *things,* " not *persons;* that age *should* be taken into account; that age " should by no means be taken into account."

These conflicting opinions may, perhaps, be not reconciled, but disposed of by citing a still higher authority. In a remarkable speech delivered in the House of Commons, as recently as 25 April 1884, on a motion by Mr. Hubbard to enforce his well-known views on the incidence of the tax, Mr. Gladstone said: " The right honourable gentleman (Mr. Hubbard) has shown " various inequalities in the income tax. I do not contest one " of them. I will not accuse him of exaggerating those inequali- " ties; it is hardly possible to exaggerate them." Mr. Gladstone proceeded to argue that these inequalities were incurable, and were objections to the nature of the tax itself, and added, that he had come to this conclusion, " after having spent more labour on " the subject than I have ever done upon almost any other subject " in my life".

After this it may seem to be the height of presumption in me to say a word. Nevertheless, I have one or two observations to offer upon points to which sufficient attention has not, I think, been given. The tax having now been levied for forty-three consecutive years with no prospect of cessation, it is idle to speak of it as a temporary impost. And under these circumstances, to my mind, the greatest anomaly and injustice of the tax, and the greatest source of danger from it to the State, arises from the circumstance, that it is levied upon a small part of the community only. With a slight verbal alteration, Adam Smith's maxim would read: Every subject of the State ought to contribute in

proportion to his ability. So that the only justification for the exemption of any subject from a tax would be, that there must be a limit below which it would not be worth the expense of collection. But, here is a tax, now producing upwards of sixteen millions annually, which no attempt even is made to collect from the recipients of weekly wages. Yet, the aggregate income of this class is enormous. And we know, from life assurance experience, that a large revenue can be obtained from this class after the expenses of collection have been paid; and that the way, and the only way, to accomplish this purpose is, by making the collection weekly.

Another matter upon which we may claim to speak from experience is, upon the allowance for life assurance premiums. The object of this allowance is to exempt savings from incomes derived from personal exertion; but how does it work? Life assurance is not all family provision; in many cases the policy moneys pass not to the families of the men whose lives are assured, but to their creditors. Take the common case of a loan on security of a life interest in property and of a policy. The annual premiums in such cases represent the instalments by which the loans are repaid; and why should such premiums be exempted from income tax any more than subscriptions to building societies, or other arrangements made for the repayment of loans? I, myself, have repeatedly in such cases signed certificates to enable the allowance on the premiums to be claimed, and that, too, for members of both Houses of Parliament. Take an actual case. From the life assurance statistics, published by the Board of Trade, it may be estimated that the aggregate amount of claims that will be paid in the present year, will be about £12,000,000. Of this, £538,648 has arisen from two deaths. This sum has been received by two assurance companies in discharge of mortgages. And yet, no doubt, the allowance for income tax on the premiums has been annually claimed. Moreover, it must not be supposed, that dealing with policies for purposes of security is confined to assurances for large sums. Assignments of policies seem to be on the increase, and are common with those of small amounts. There is something like a general admission, that the tax presses more hardly upon incomes derived from personal exertion than upon those derived from property. Instead of seeking to alleviate this hardship by the absurd device of exempting one-sixth of the income, provided that it be devoted to life assurance, would it not be simpler, and more just, to enact,

that the tax levied under Schedules D and E should be five-sixths of that levied under Schedules A and C? To this there would be no practical difficulty.

I now come to the incidence of the tax on assurance companies, which, I think, is peculiar, and which has not received proper consideration. First, as to exclusively life assurance companies. Their business is to receive premiums, to accumulate these premiums at interest, and to equalize life by paying at death, not the accumulated contributions of each individual, but the amount contracted to be paid when death occurs. If the accumulated premiums, after deduction of expenses, exceed what is required to meet the claims, there is a surplus, which is commonly, but, I think, erroneously, called profit. But, what is not the case in other descriptions of assurance, the premiums alone are not sufficient to meet the claims; the interest being as much required for this purpose as the premiums. For instance, £3 per-cent represents, as nearly as may be, the rate per-cent of annual premium, without participation, at the age of 41. At that age, the average duration of life is between 26 and 27 years. So that 1,000 men at the age of 41 effecting life assurances of £100 each will, altogether, pay in premiums 27 × £3,000, or £81,000 in all; while the amount to be paid in claims is £100,000. The explanation is, that the premiums accumulated at interest will yield a much larger amount than £81,000. But the Income Tax Act makes no distinction between the interest on life assurance funds required to meet ordinary liabilities, and the interest on the investments of a private individual, or the reserve funds of a trading company. And as the tax on interest is usually levied by deduction at its source, the Government obtains from the life companies the tax, not upon their profits, but upon the interest of their funds, a much larger amount.

Next, as to the other companies carrying on conjointly with life assurance, fire, marine, accident, or any other form of insurance business. In these last kinds of insurance the finance is simple. The premiums alone must be sufficient to meet the claims and expenses; if there be any surplus after these have been satisfied, such surplus is profit, and as such justly assessable to income tax. By the exclusively life companies the return to the revenue authorities is made in some such form as this. "This company "has no return to make, the amount deducted from dividends on "stock, interest on mortgages, &c., exceeding its annual profits." Of late years no exception, I believe, has been taken to this

return; but, I have heard that it was a subject of some controversy when the income tax was first re-imposed.

With the returns of the other assurance companies all is confusion. Not only are they made out in different ways, but the same company has more than once altered the principle on which its returns have previously been made, in order to meet the views of different surveyors of taxes; no one of whom is bound by the acts of his predecessors. Under these circumstances, about six years ago, the London Assurance determined to contest the claim made by the surveyor, who declined to adopt the method which had been agreed upon with his predecessor. The contention of the surveyor was, "that life assurance, from its peculiar nature, does "not fall within the scope of the Income Tax Acts, except as to "the interest from the capital invested in securities; that the profit "earned by any life insurance society is derived solely from these "investments of capital. That this being so, there is nothing to "take into account, either in the way of profit or loss beyond the "amount of the untaxed interest". In short, he claimed, that the assessment should be made on the amount of this "untaxed "interest" added to the profits of the marine and fire departments, omitting the life department altogether. The contention of the other side was, that the annual profit must be arrived at by adding together the marine and fire profits, the proprietors' share of the surplus of the life department, and the interest on all the funds, except the life funds, deducting from the total the whole expenses. But, as tax had already been paid by deduction from interest on investments, it was contended, that if the taxed interest exceeded the profit, as with the exclusively life companies, no further tax should be demanded. If, on the contrary, the profit exceeded the taxed interest, the assessment should be made upon the amount of this excess.

The case was heard before the Commissioners on 12 February 1880, who decided against the Crown, and, on being required by the Surveyor, stated a case for the opinion of the Courts of Law. This was argued before the Queen's Bench Division on 14 March 1884. Mr. Justice Day, in delivering judgment, said that four questions were submitted for the determination of the Court: (1) Whether the fund appropriated by way of bonus among the policyholders constitutes gains or profits within the meaning of the Income Tax Acts; (2) If not, whether the company had the right to deduct the whole expenses; (3) As to the right of the Crown to levy the duty upon the life fund; (4) As to whether

the business of the company is to be dealt with as a whole, or as three separate businesses.

All these questions were answered against the Crown: (1) and (3) in the negative, (2) in the affirmative; and (4) that the business was to be dealt with as a whole. Mr. Justice A. L. Smith differed with his colleague on the first, but concurred with him on the other three questions. He afterwards withdrew his judgment, so that the decision was against the Crown on all points.

It should be mentioned that the second question affects the particular arrangements of the London Assurance, and therefore need not be further referred to. The three other questions are of general interest.

The Law Officers of the Crown acquiesced in this judgment upon the three last questions, but carried the first question to the Court of Appeal. This acquiescence should not be overlooked, because, to my mind, the third question is much the most important of them all. I am anxious, therefore, that it should be clearly understood that no attempt has been made to contest the decision that the Crown has not the right to levy income tax upon life funds.

The Court of Appeal, on 15 November 1884, by a majority of two to one, confirmed the decision of the Court below on the first question.

Finally, this question was taken to the House of Lords, which tribunal, on 14 July last, also by a majority of two to one, reversed the decisions of the Courts below, and decided that bonus allotted to life policyholders formed part of the profits of the company assessable to income tax. Of the eight judges who in the different Courts delivered judgment, four—namely, Lord Blackburn, Lord Fitzgerald, Lord Justice Lindley, and Mr. Justice A. L. Smith—answered this question in the affirmative, and four—namely, Lord Bramwell, the Master of the Rolls (Lord Esher), Lord Justice Cotton, and Mr. Justice Day—in the negative. Seeing that judicial opinion was thus equally divided, I may perhaps be allowed to say that it would have been more satisfactory if the House of Lords, before giving judgment, had required the case to have been re-argued before a fuller Court. However, the law has now been authoritatively pronounced, and for proprietary companies may be stated to be:

(*a.*) That the assured's share of the surplus is part of the profit of the company assessable to income tax; but that the tax on this share is not payable by, and cannot be charged to, the assured.

This was the only question taken to the House of Lords, and the only one on which the judgment of the Queen's Bench Division was reversed. The other questions decided by the latter tribunal, and in which no appeal against the judgment has been made, are,—

(*b.*) That the Crown has not the right to levy the tax upon life assurance funds; thus disposing of the claim to the duty on untaxed interest which has been made of late years.

(*c.*) That with companies carrying on, conjointly with life assurance, marine, fire, accident, or any other branch of insurance business, the assessment is to be made upon the profits of the business as a whole, and not upon any branch or branches separately.*

In this state of things, it seems to me that the time has arrived for a combined effort to obtain an amendment of the law. The Crown not having the right to levy the tax upon the interest of life funds, justice requires that any such tax deducted at its source should be returned, and that a clause authorizing such return should be inserted in the Act, similar to the clauses relating to the property of friendly societies and charitable institutions. Interest would then be received in full by the companies, and they would have to make a return of, and be assessed upon, their actual profits. This would have been their exact position if the first Income Tax Act of 1798 were now in force. The change in the law was made, not to surcharge those who made truthful returns, but because it was found that, on account of the numerous evasions of the tax, another mode of collection was necessary.

* The form in which the return has been made by the London Assurance since the judgment of the House of Lords was given, and which has been approved by the revenue authorities, is as follows:

Let m = marine profit of the year.
f = fire " "
l = surplus of the life department ascertained at the last quinquennial valuation.
i = interest on all the funds, *except the life funds.*
e = expenses.
t = interest on *all* the funds from which the tax has been deducted.
P = profit on which income tax is payable.

Then $P = m + f + \frac{l}{5} + i - e$.

But the tax has already been paid upon t, by deduction at the source. If, therefore, $P < t$, no further payment has to be made. If, on the contrary, $P > t$, the amount to be paid is the tax on $P - t$.

The Crown counsel, in the course of their arguments, stated that this question of the assured's share of the surplus was important to the revenue, because it affected the returns of all the mutual assurance societies in the kingdom. As a matter of fact, I believe that the decision of the House of Lords will affect one of them only, whose rates of premium are higher than those of its contemporaries; and that, with this exception, none of the exclusively life companies, mutual or proprietary, will make any *direct* payment of income tax. With the other companies, the case is different, as they can bring into account the profits on their other branches of business. But the injustice remains of requiring the assured's share of the surplus to be included, and it is not confined to assurance companies. By the law as now laid down, A must pay income tax on profits enjoyed by B. For instance, a not uncommon arrangement between author and publisher is for the latter to take the risk and expense of bringing out a book, the profits, if any, being equally divided between the two. But the income tax on the whole of the profits would, in such a case, have to be paid by the publisher, none being paid by the author. That this is no exaggeration, the following characteristic extract from the conclusion of Lord Bramwell's judgment will show:

"If the Crown is right, who will pay the income tax on the whole three-thirds? The shareholders? If so, they would pay on profits they do not receive. The participating assured? Then they would pay on something which is not within the Income Tax Act. If the contention of the Crown is right, income tax will be payable in all cases in which employers have agreed with employed that, besides fixed wages, the employed shall receive what is called a share of the profits. The income tax will apply to co-operative societies strictly so called, and be payable on a sum falsely called profits, with no deduction of the wages contingently payable to workmen, if gross profits enable them to be paid. This Mr. Dicey in effect admitted. I think it would be most disastrous and most unreasonable, as much so as if a man gave £1 to a fisherman to go fishing, and a tenth of the fish, or a tenth of what remained of the price of the fish after deducting for the boat, &c., and then was charged to the income tax without deduction for the fish given or allowance made to the fisherman. I cannot truthfully say I have the least doubt in this case, except that which arises from my respect for the opinion of the other noble and learned lords."

After such an emphatic expression of opinion from such a quarter, we may not unreasonably look for a change in the law; and, in the belief that the Institute may render service in accom-

plishing this result, I ask the members to give the whole subject due consideration.

Postscript.

Since this paper was written the members of the Institue have heard from the chair that life assurance is a trade,—that life assurance societies, both mutual and proprietary, are trading bodies,—that the bonuses, periodically divided among the assured, are trading profits, except when applied in abatement of the current year's premium. A strange exception; for why deductions from the annual premium, when the sum assured is fixed, are not profits, while additions to the sum assured, when the annual premium is fixed, are profits,—is hard to be understood. But, as having some bearing on the present subject, I wish to protest against this *ex cathedrâ* dictum, and, sheltering myself under the *ægis* of Lord Bramwell, to maintain, that clubs, co-operative associations, and mutual assurance societies, are organizations of bodies of men to carry out objects unattainable by a single individual. But they are not trading bodies, and if conducted on trading principles, the effect is to increase the cost to the members.

The decisions of the Courts in this income tax case bring into bold relief the different views entertained of life assurance profits. The Crown contended that the only profits of life assurance companies arise from the interest on their funds. The Court decided that the income from this source is not profit at all, and ought not to be taxed. The Assurance Company said that it made profit from its life business, such profit being not the interest of the life fund, but the share of the surplus of that fund appropriated to the company. The House of Lords decided that the assured's share of the surplus must be included in this profit. The President of the Institute of Actuaries concurs in this decision, saying, that proprietors and assured are partners in a trading concern, and that the surplus is the trading profit. But I suspect that he will shrink from the conclusion that has followed, namely, that while the profit is divided among all the partners, the income tax on this profit has to be paid by one section of the partners only, and that the class which receives much the smaller share of the profit.

LAW REPORTS.

Last v. *The London Assurance Corporation.*

As the foregoing paper contains a commentary on the recent judgment in the action of *Last* v. *The London Assurance,* which was carried from the Queen's Bench Division of the High Court of Justice to the Court of Appeal, and was finally disposed of by the House of Lords, and as that case will now become the leading case in reference to the assessment of life assurance companies for the purpose of income tax, we believe we shall be studying the convenience and wishes of our readers by reprinting, in the pages of the *Journal,* the full official text of the various judgments that were delivered.

IN THE HIGH COURT OF JUSTICE, EXCHEQUER DIVISION.

(Queen's Remembrancer.)

Between WILLIAM HARRISON LAST . . . Appellant,

and

THE LONDON ASSURANCE CORPORATION Respondents.

CASE,

Stated for the Opinion of the Court under Part III of the Act 37 & 38 Vict. cap. 16.

This is a Case stated under the Statute 37 Vict. cap. 16, sect. 9, by the Commissioners for the General Purposes of the Income Tax Acts for the City of London, for the Opinion of the Exchequer Division of the High Court of Justice.

At a Meeting of the Commissioners for the General Purposes of the Income Tax Acts, and for executing the Acts relating to the Inhabited House Duties for the City of London, held at the Land-Tax Rooms, Guildhall Buildings, in the said City, on Thursday, 12th February 1880.

Mr. John Philip Laurence, on behalf of the London Assurance Corporation, appealed against an Assessment made upon them under Schedule D of the Income Tax Acts, for the year 1879, in the sum of £40,797 in respect of the profits of the Marine and Fire Branches only, the Life Branch being entirely disregarded.

The London Assurance is a Corporation incorporated by Royal Charter, having a Common Seal, and one body of Shareholders, with a paid-up Capital of £448,275.

The Central Office is in London, and it there carries on three branches of business, namely, Marine, Fire, and Life Insurance, all managed by the same Directorate.

The results of the business in the three departments are thrown into one Account called the "Profit and Loss Account", and dividends are declared out of the balance of this Account, and not out of profits made in the particular departments.

The liabilities of the London Assurance to policyholders are discharged partly out of premiums, partly out of the Income arising from large invested funds, which in the management of their business are allocated to the Marine, Fire, and Life Departments respectively, and are hereinafter referred to as the Marine, Fire, and Life Funds. The Life Fund is much the largest of these investments. Income Tax is deducted from the greater part of the income arising from these respective funds before payment thereof to the London Assurance.

As a matter of account the funds are thus divided:

(*a*) Paid-up Capital.
(*b*) General Reserve Fund, including balance of Profit and Loss Account.
(*c*) Marine Fund.
(*d*) Fire Fund.
(*e*) Life Fund.

The income arising from the interest and dividends on the Marine, Fire, and Life Funds, on an average of the last three years, and from which Income Tax has been deducted, has been as follows:

Marine and Fire	7,304	3	10
Life	76,850	12	0
	£84,154	15	10

The London Assurance have therefore paid Income Tax on £84,154. 15*s*. 10*d*. in respect of these Funds.

The profits of the London Assurance are derived from the following sources:

(1) Interest on paid-up Capital and Reserve Fund.
(2) Profit on Marine Business.
(3) Profit on Fire Business.
(4) Profit on Life Business.

Respecting the profits derived from the interest on the paid-up Capital and Reserve Fund no question arises. They are not included in the return, because Income Tax is levied and paid by deduction from the interest and dividends of the investments of those Funds.

As regards the other three sources of profits available for division among the Shareholders, the Corporation contend that the results of the three branches, Marine, Fire, and Life, should be thrown into one general Account, and that no distinction should be made between the Life Branch of its business and the other two; and that if, and in so far as, the total sum on which they pay Income Tax in respect of their investments, exceeds the sum total of the profits they make, they are not liable to be assessed under Schedule D.

That in making up the amount of the Life Profit to be entered in the return for purposes of Income Tax, the amount to be so entered must be the profit, and no more than the profit, available for division among the Shareholders, and that the gross profits so arrived at on an average of the last three years have been as follows, namely:

	£	s.	d.
Marine	27,635	11	9
Fire	75,766	19	5
Life	27,454	9	5
	£130,857	0	7
Deduct expenses	57,597	10	0
	£73,259	10	7

The net profits being £73,259. 10*s.* 7*d.*, and the London Assurance having paid Income Tax on £84,154. 15*s.* 10*d.*, or on £10,895. 5*s.* 3*d.* more than the sum available to it for profits, the Corporation maintain that the assessment is wholly wrong, and should be discharged.

Mr. William Harrison Last, Appellant, the Surveyor of Taxes, on behalf of the Crown, contended that Life Insurance from its peculiar nature does not fall within the scope of the Income Tax Acts, except as to the interest from the capital invested in securities; that the profit earned by any Life Insurance Society is derived solely from these investments of capital, and that this is notably so in the case of the Corporation; that this interest is either taxed by deduction at its source, or, when received in full without such deduction, is chargeable as interest on the full amount received under the 4th and 5th cases of Schedule D.

That this being so there is nothing to take into account, either in the way of profit or loss, in connection with the Life branch beyond the amount of the untaxed interest.

The Surveyor further urged on behalf of the Crown that, assuming the Corporation to be right in its contention that the Life branch as well as the Marine and Fire branches should be brought into the account, the assessable profits of the Life branch were not to be determined merely by the amount of profit available for division among the Shareholders, but would require to be found according to the third rule of the first case of Schedule D.

That, over and above the profit so appropriated to the Shareholders, the printed accounts of the Corporation showed—

> *First.*—Sums paid to Policyholders in the shape of bonuses, which was a distribution of assessable income or revenue.
>
> *Second.*—Additions made to the Life Fund, which was a transfer of income to capital.

That, to arrive at the net balance of profit chargeable for the Life branch under the above rule, it was required on the one hand to take account of the Life premiums received during the last three

years, and on the other to allow as deductions nothing beyond the claims actually paid under policies becoming payable in the same period, together with the expenses of managing the business; that the balance remaining would be the profit chargeable to the Income Tax for the Life branch; and that this profit, added to the untaxed profit of the Marine and Fire branches, would represent the total liability of the Corporation under Schedule D.

In reply to this alternative contention of the Appellant (the Surveyor of Taxes), the London Assurance Corporation stated—

In the Life Branch of the London Assurance business there are three classes of policies, called the "Old", the "1831", and the "1846" series. The three classes are worked independently. As regards the "Old" series, any surplus which remains after payment of policies belongs to the Corporation for payment of expenses and profits. As regards the "1831" and "1846" series, by the terms of the contract with the assured, the surplus which remains after payment of policies is dealt with as follows:—Two-thirds of the surplus are returned to the assured, who receive payment either by way of bonus or by abatement of premium.

The remaining third of the surplus goes to the London Assurance, who bear the whole of the expenses of the business. The portion that remains after payment of expenses constitutes the only profit of the Corporation available for division among the Shareholders.

The printed copies of the accounts of the Corporation for the three years 1876, 1877 and 1878, are annexed and form part of the Case.

The Commissioners held that the claim of the London Assurance Corporation to be taxed in respect of the profits of the three branches, Life, Fire, and Marine, be allowed, and as it appeared that the taxed investments exceeded the profits of the three branches (as arrived at by the Corporation) discharged the assessment.

Whereupon the Surveyor declared his dissatisfaction with their decision, and duly required the Commissioners to state and sign a Case for the Opinion of the Exchequer Division of the High Court of Justice; which we have stated and signed accordingly in pursuance of the 9th section of the 37th Vict. cap. 16.

The question for the opinion of the Court is—

> Whether or not, for purposes of assessment to Income Tax, the London Assurance is to be dealt with as a single Corporation, the Income Tax payable by it being determined with regard to its operation as a whole, and upon what principle the profits of the Life branch should be calculated.

THOMSON HANKEY,
G. R. BENGOUGH,
BONY. DOBREE,
W. C. FOWLER,
} Commissioners.

3 Guildhall Buildings,
10 June 1880.

IN THE HIGH COURT OF JUSTICE, QUEEN'S BENCH DIVISION.

(Queen's Remembrancer.)

Friday the 14th day of March 1884.

Between W. H. Last (Surveyor of Taxes) . . Appellant,
and
The London Assurance Corporation Respondents.

Whereas in pursuance of the 9th section of "The Customs and Inland Revenue Act, 1874", a Case had been stated, at the request of the above Appellant, for the opinion of this Court by the Commissioners for the general purposes of the Income Tax Acts for the City of London. And whereas the said Case came on to be heard on the 13th day of March instant, when upon reading the same, and hearing Sir Henry James, Knight, Her Majesty's Attorney-General for the Appellant, and Sir Hardinge Giffard, Knight, Q.C., for the Respondents, and the said Attorney-General in reply, the matter was adjourned for judgment until this day. Now the Court are of opinion that the decision of the said Commissioners discharging the assessment made upon the Respondents is correct, and affirm the determination of the said Commissioners. And do order that the costs of said Respondents of this Appeal be paid to them by the said Appellant. And it is hereby referred to the Queen's Remembrancer to tax such costs.

W. F. POLLOCK,
Q. R.

Entered 21st March 1884.

IN THE HIGH COURT OF JUSTICE, QUEEN'S BENCH DIVISION.

14 *March* 1884.

Last (Surveyor of Taxes) . . . . . Appellant.
The London Assurance Corporation . . Respondents.

Before Mr. Justice Day and Mr. Justice A. L. Smith.

JUDGMENTS.

Taken from the Report 12 *Q.B.D.* 397.

Mr. Justice Day.—This is an appeal from a decision of the Income Tax Commissioners for the City of London, and four questions are more or less specifically submitted upon the special Case for the determination of this Court.

The Respondent Company is a proprietary company, which carries on the business of Marine, Fire, and Life Insurance.

In the life department they issue policies of a non-participating and also policies of a participating character. The former are issued

at premiums which are calculated, when duly invested at compound interest, to cover all risk, and, after payment of proportionate expenses of management, to yield a profit to the Company; the latter are issued at higher premiums, which are similarly calculated not only to cover all risk and expense, but also to yield a considerable surplus over and above shareholders' or company's profit, out of which benefit and relief may be expected for the participating policyholders according to their fulfilment of their life expectation, and, accordingly, of this surplus, two-thirds are by the terms of the policies to be apportioned among these policyholders, while the remaining one-third is to be divided among the shareholders of the Company, or be otherwise applicable for the benefit of the Company. This surplus is determined quinquennially by ascertaining actual results and calculating contingencies, and the two-thirds which are distributable among the participating policyholders make up a fund which is distributed either in cash payments, or by way of reduction of premiums, or by addition to the amounts insured. It is conceded that income tax is, as a matter of course, payable upon the latter one-third.

The first question submitted to us is whether the fund so appropriated for distribution by way of bonus among the policyholders is or is not liable to be assessed to the income tax, or to put it in another form, whether it constitutes gains or profits within the Acts regulating the income tax. Now, profits (and, for the purposes of this case, I shall consider that term alone) may be taken here to mean the surplus of income after defraying all, at least necessary, expenses of making it; and if the setting aside this fund for bonus distribution was a necessary expense of making the income, it would certainly not seem to be profit in the above sense, it would be that which according to the definition is to be deducted before the profit can be got at. But this fund is precisely that which the participating policyholders stipulated by their contract should be set aside for them as a charge in their favour, and should be expended upon them; it constitutes the sole consideration for their paying the increased premiums. Without such covenant this fund, which is built up out of these increased premiums, would not have come into existence. The setting aside of this fund—the fund itself—is then an expense necessary to the formation of the whole bonus or participating policy profit fund; but, clearly, it is not profit; not true or net profit, but it is, instead of true or net profit, an expense which has to be deducted from gross profit before true profit can be got at. It seems to me quite unimportant that the policy contract provides for apportionment of profits; that term is there used in a very general sense, and it is clear that the mere word "profit" does not solve any difficulty. Take a simple and not unfrequent illustration; a company appoint a manager at a nominal salary of, say, £100 per annum, and to stimulate to effort and economy combined, they give him besides, say, 1 per-cent upon profits. From the latter source he derives, say, £1,100 per annum. His whole income, namely, £1,200 per annum, is a charge and expense, and diminishes the true profits of the Company, and the Company could not be made responsible for the income tax upon the £1,100 any more than for that upon the £100 per annum, both being alike expenses of getting the gross income. It seems to me clear

that the Company make their own profits, that which constitutes their one-third, certainly as to any excess of profit they may get out of participating as distinguished from non-participating policies, by agreeing to distribute and pay, and by paying away to the holders of the former the bonus fund by way of inducement to insure; they do it to get the business, to get the income, and it therefore seems to me to be merely an expense necessarily incurred by the Company to procure the fund, namely, the one-third of general profit, which it divides among its shareholders, or otherwise appropriates to itself.

Were it material, I should be disposed to hold that bonus is not profit even in the hands of a policyholder. No doubt it is in a sense an advantage, although certainly not profit, just as a legacy may be an advantage, but is certainly not profit. Bonuses are indeed rather inconsistent with the true idea of profit. Speedy death is profitable in life assurance. The longer a man lives the more bonuses, no doubt (*cæteris paribus*), will he get, but at the same time more premiums will he pay, the more interest will he lose, the longer will his estate be kept out of the expected capital, and therefore a bonus can only be regarded as at best a reduction or mitigation of loss, and certainly not as profit, even to the policyholder.

I may further observe that the fact mentioned by Counsel in argument, that income tax is not levied upon the funds of mutual societies which are available for bonus, seems consistent with the view which I take of the liability of those funds of proprietary companies which are applied to bonus upon the mutual principle.

Here I may pause to observe that no one can doubt, irrespective of the authority of the case which has been cited (Mersey Docks *v.* Lucas*), that the destination of profits is utterly irrelevant upon this subject. If profit, true profit, is once existent, it matters not whether it is thrown away or well invested, spent freely or under compulsion, whether of contract or of statute.

I am of opinion, for the reasons above given, that the judgment of the Court upon this first question should affirm the decision of the Commissioners and should be against the Crown.

The second question presented to us is as to the right of the Company to deduct the whole expenses, if there is no liability to pay duty upon the bonus fund.

I say that this should be answered in the affirmative, because the expenses are all necessary to realize the nett profit which remains for the Company, and upon which they pay the duty.

The third question is as to the right of the Crown to levy the duty upon what has been termed the life fund. This should, in my opinion, be answered in the negative. The case of the Imperial Fire Assurance Company *v.* Wilson,† to which our attention has been directed, has, in my opinion, no bearing upon the subject. In the course of the argument I have pointed out the radical distinction and difference between fire and life assurance, and I will not repeat myself further than to observe generally that, as fire insurances run out in all their incidents in one year, each payment of premium representing a thoroughly fresh transaction, it practically matters not to either side

* 8 App. cas. 891. † 35 L. T. 271.

for income tax purposes whether the profit, which is in such case simply the excess of annual premiums received over annual losses actually sustained, is ascertained with minute accuracy by reference to the current year of each policy, or whether one takes the arbitrary year of the calendar and assumes that to be the true policy year in respect of all receipts and payments within it, the average must be substantially the same in either. In life insurance each year's premium has relation to the whole duration of the life or risk, and every year's premium has to be set aside and capitalized for payment of the future debt; in no sense, whatever, can the life fund as such be deemed to represent profit.

The fourth and last question submitted to us is whether the business of the Company is to be dealt with as a whole, or whether it is to be dealt with as three separate businesses—marine, fire, and life insurance.

This bears upon the right to take credit generally for the income tax actually paid upon the interest on investments, which mainly belong to the life insurance fund.

It seems to me that, although the funds and accounts are naturally as well as under compulsion of law kept separate, the business is substantially one business carried on by one corporate person, and that the decision of the Commissioners was hereon also correct.

I am, therefore, of opinion that the Crown have failed upon all points, and that the judgment of the Court should be in favour of the Respondents.

A. L. Smith, J.—I agree in the judgment of my brother Day, except in so far as it applies to what may be called the bonus policyholders. I have nothing to add upon the three points upon which I agree.

As regards the bonus policyholders, it is alleged on the one side that the bonuses paid to them are not assessable to income tax, whereas the Crown avers that they are.

The real question is whether in this case the amounts paid by way of bonus are or are not gains and profits of the Corporation within the meaning of the Income Tax Act.

It is necessary to consider what is the real position of a bonus policyholder, and it may also, as it seems to me, be well to see how and in what way he differs from a shareholder of the Corporation. In the case of a shareholder the position is this, the Corporation contract in consideration of money paid by him to the Corporation, that they will, out of the gains and profits of their trading, pay to the shareholder from time to time a proportion of such gains and profits by way of dividend. In the case of a bonus policyholder the position, as it seems to me, is this. The Corporation contract, in consideration of money paid by him to the Corporation by way of premium, that they will pay upon his death the amount stipulated to be paid by the policy, and also that they will, out of the gains and profits of their trading, pay to him from time to time a proportion of such gains and profits by way of bonus. That is, as it appears to me, the relative position of a shareholder and a bonus policyholder in the Corporation.

It is conceded that the amount distributable to the shareholder is chargeable with income tax. Why? Because it is part of the gains and profits made by the Corporation. I cannot myself see why the residue, as I hold it to be, of the same fund which is distributable to a policyholder by way of bonus should not equally be chargeable to the income tax, and I hold that it is. The gains and profits of the Corporation out of which each is to be paid, are ascertained, as it seems to me, in the same way. On the one side are placed interest upon capital (and in this is included interest upon all investments, bad or good, whatever they may be, which are made by the Corporation), premiums received, and any other amount paid into the coffers of the Corporation. On the other side are placed payments made on policies, expenses of management, and so on. The credit balance, if any, is, in my judgment, the gain and profit made by the Corporation; out of this fund, *i.e.*, the gain and profit, both the shareholder and bonus policyholder are respectively paid his dividend and bonus. I do not accede to the position that the bonus is merely a return of the premium to the policyholder which is ascertained to be in excess of what the Corporation should have taken from the policyholder. In my opinion it is not so. As before stated, the bonus policyholder pays his premium, as I hold, to the Corporation in consideration or upon condition that the Corporation will pay the amount of the policy at his death, and in the meantime allow him to participate in the gains and profits, whatever they may be, of the Corporation, which may happen to accrue from their trading. It entirely depends upon what those gains and profits are, what bonus, if any, he receives. It is suggested that the bonus payable to policyholders should be deducted before the gains and profits of the Corporation are ascertained, and this is said, as I understand, to be so, because each premium, when paid by the policyholder to the Corporation, is clogged with the condition that if there be any excess in the premium charged such excess shall be paid back. As above stated, I hold that this is not the real position of a bonus policyholder towards the Corporation. All that the bonus policyholder is entitled to is a proportion of the balance, after giving credit for all moneys received, and debiting against that sum the disbursements of the Corporation. The above is my opinion. It is with diffidence that I state it, being, as I unfortunately find myself, at variance with my brother Day; but, holding it as I do, I am bound to deliver it. If I am right, and if gains and profits are to be ascertained as above mentioned, then it seems to me the case cited by the Attorney-General of Mersey Docks *v.* Lucas * is an authority in the Crown's favour; for when once gains and profits are attained, that case decides that it is immaterial what the ultimate destination of the same may be. For these reasons I am of opinion that the Crown's contention as to this is correct, and that the bonuses paid to the policyholders are assessable to income tax.

[As the Court were equally divided on the question as to amounts

* 8 App. Cas. 891.

paid to bonus policyholders, A. L. Smith, J., withdrew his judgment on that point, and the appeal was dismissed.]

Judgment for the Respondents.

IN HER MAJESTY'S COURT OF APPEAL.

On Appeal from the Queen's Bench Division of the High Court of Justice.

Between WILLIAM HARRISON LAST (Surveyor of Taxes) Appellant,
and
THE LONDON ASSURANCE CORPORATION . Respondents.

TAKE NOTICE that the Court of Appeal will, at the expiration of fourteen days from the service of this notice, or as soon thereafter as Counsel can be heard, be moved by Counsel on behalf of the above-named Appellant, that the judgment of the Queen's Bench Division in this case, entered the 21st day of March 1884, may be reversed or varied, or that such other order may be made in the premises as to the said Court of Appeal may seem meet.

Dated this 1st day of April 1884.

W. H. MELVILL,
Solicitor of Inland Revenue
for the above-named Appellant.

To Messrs. Collyer-Bristow,
Withers, Russell, and Hill,
Solicitors to the above-named
Respondents.

IN HER MAJESTY'S COURT OF APPEAL.

Saturday the 15th day of November 1884.

WILLIAM HARRISON LAST (Surveyor of Taxes) . Appellant,
and
THE LONDON ASSURANCE CORPORATION . . Respondents.

On Appeal by the Appellant from an Order of the High Court of Justice, Queen's Bench Division, Revenue Side, dated the 14th day of March 1884.

UPON reading the above-mentioned Order and the Notice of Appeal herein, and on hearing Sir Henry James, Knight, Her Majesty's Attorney-General, and Mr. A. V. Dicey, of counsel, for the Appellant, and Sir Hardinge Giffard, Knight, Q.C., for the Respondents, and the said Attorney-General in reply.

IT IS ORDERED by the Court that the said Order of the 14th day of March last be and the same is hereby confirmed.

AND IT IS further ordered that the costs of this Appeal be paid by

the said Appellant to the said Respondents. And it is hereby referred to the Queen's Remembrancer to tax such costs.

W. F. POLLOCK,
Q. R.

Entered 22nd November 1884.

IN THE COURT OF APPEAL.

15 *November* 1884.

LAST (Surveyor of Taxes) . . . . . Appellant.

THE LONDON ASSURANCE CORPORATION . . . Respondents.

Before THE MASTER OF THE ROLLS, LORD JUSTICE COTTON, and LORD JUSTICE LINDLEY.

JUDGMENTS.

Taken from the Report 14 *Q.B.D.* (*C.A.*) 241.

Brett, M.R.—It seems to me that, by the Income Tax Acts, people who carry on a trade or business are to pay income tax upon the profits of the business which is theirs. The profits within the meaning of those Acts are, I think, those things which ordinarily in a business sense are called profits of the person who is carrying on the business. They are the receipts which he receives from the business, less the expenses to which he is put in order to earn these receipts. The receipts are procured from the people who deal with him, properly called his customers. The expenditure is what he has to expend out of these receipts, or otherwise, in order to obtain these receipts. The only person to be considered in the matter is the person who is carrying on the business, and he is the person who has to pay the income tax. In order to consider that matter with regard to him, therefore, you have to consider him as a person in antithesis to the persons called his customers. Now, a business may be carried on by an individual, or by an ordinary partnership, or by a company which has shareholders. Where a business is carried on by a company which has shareholders, the company carry on business nominally, but the people who are really carrying it on, and for whose benefit it is carried on, are the shareholders. Therefore, in such a case, when you are considering the people carrying on the business as distinguished from the people who are dealing with them, the two opposite sets of people are the shareholders and the customers. Then in this case of a life assurance business, the people who are carrying on the business are the Company as representing the shareholders, and the people with whom they carry it on are the customers who take policies and who pay premiums thereon. The business is carried on, in fact, in this way:—The customers when they take out the policies, and as long as the policies remain, pay annual sums of money in respect of them, and those sums are the gross receipts

of the Company. Now, what do the Company, in fact, expend in order to get that business? There are the expenses of management and those ordinary things which are not now in question. But what else do they expend? Upon certain conditions they pay to the customers certain sums of money in each year. Can it be suggested by business men that the Company, out of mere benevolence, pay money to their customers? Why should they? In business, money is not paid out of affection, but for a business purpose, namely, to induce people to become customers or remain customers. There is no other business reason for it. If so, it is an expenditure which is made in fact, in order to get the receipts from the Company's customers. Now the profits on which the income tax is to be paid in a trade or business, are the annual profits, and such profits are arrived at by making up the accounts, and seeing what has been received in the year, and what has been paid, in order to get those receipts. The profits are the difference between the two. When the Company have got the profits, they may deal with them in several ways. If they put them to the reserve fund they are still the Company's. But how can that which is paid back to people with whom they are dealing be part of the business profits? That is a thing I cannot understand. The Attorney-General was obliged to argue that your customer is your partner, which is almost a contradiction in terms. It is difficult, no doubt, to distinguish between that which goes to the shareholders, and that which goes to the customers. The distinction to my mind is this, that the shareholders are the people carrying on the business, and what goes to them is the very thing which has to pay income tax. But what goes to the customers is something which does not go to the shareholders, and which does not go to anybody who is carrying on the business, but to the people with whom the persons who are carrying on the business are dealing. That is the whole distinction, as it seems to me. The whole thing comes after all not to be a question of law, for we are all agreed about the law, but to this: if this is a part of the profits of the business, we are all agreed the Company must pay income tax upon it; but if it is to be looked at as an expenditure which the Company make in fact, in order to enable them to earn their receipts, then we are all agreed that the income tax must only be paid upon what are the receipts after deducting it. It seems to me that in business, and according to the ordinary modes of business, what a person keeps or deals with for his own benefit is that which is to be taxed, and what he pays to his customers in order to induce them to become, or to remain, customers, is part of his expenditure, and cannot be brought into the subject matter of taxation. I therefore think that the money which the Company pay in fact, in order to induce their customers to deal with them, is an expenditure, and consequently my judgment goes with my brother Day, and I think that the appeal must be dismissed.

Cotton, L.J.—The question here is a short one but a nice one. It has been decided by the House of Lords in Mersey Docks *v.* Lucas,* agreeing with this Court, that even if by statute profits are

* 8 App. Cas. 891.

to be applied in a particular way which prevents the corporation receiving them from getting any benefit, they are still assessable to the income tax, and the real question here is this: whether what is divided between the policyholders is profits so as to be assessable under the Income Tax Acts, or whether it is a sum to be deducted before the profits are ascertained. Now the Master of the Rolls has stated, and I quite agree with him, what the profits in carrying on a business are. They must be the receipts after deducting all sums honestly paid for the purpose of producing those receipts. In my mind the difficulty arises very much from the ambiguous use of the word "profits." What are the profits in the participating policies, a proportion of which goes to the participating policyholders? They are not the net profits. As I understand, the expense of management is not thrown on that sum which is divided between the policyholders, but is borne by the portion which goes to the shareholders. The contract with the policyholders is this,—If, after paying certain expenses, there remains a surplus sum, then such policyholders are to have a certain portion of that. In my opinion that is not a distribution of profits when really ascertained, but of a sum which, by contract with the policyholders, the body taxable, that is this Company, agree to pay to those who will deal with them. Undoubtedly that must increase the number of customers who might be induced to take policies on the participating system, and, in my opinion it is paid honestly for the purpose of securing a larger amount of return from the business than would otherwise come to the Company. By the Act of 5 & 6 Vict. c. 35, s. 54, in the case of a Company, an estimate has to be made on the amount of the annual profits and gains of such Company before any dividend shall be made "to any other persons, corporations, "or companies having any share, right, or title in or to such profits "or gains." That might seem to be against the view I entertain; but the word "dividend" there clearly, in my opinion, means that which is to be divided between those who claim it, not by their contract with the Company, but by their position as shareholders. Undoubtedly their position as shareholders depends upon that which was their contract with the association when they joined it, but that is only regulating their position as shareholders. The profits or dividends which they get, they get quâ shareholders, and in my opinion it would be impossible here to contend that because by contract these policyholders are entitled not only on death to a certain fixed sum, but also to certain bonuses from time to time, that they receive those bonuses as shareholders or partners in the concern. They receive them by an independent contract which is made with them, not as shareholders, but as customers of the concern. In my opinion, therefore, this sum, about which the only question is now raised, ought not to be charged with income tax.

Lindley, L.J.—I am unable to take the same view. I cannot myself hold as a matter of fact that these bonuses are in any way mere expenses incurred in earning the receipts of the Company. Of course I see that the larger the bonus held out to people who effect policies the greater is the inducement to insure with the Company. But these bonuses are not like the expenses of management, or

anything that must be necessarily incurred for the purpose of carrying on the business. I cannot see how the fund for division can be regarded as spent in earning itself. In my view the fund which is divided partly among the shareholders and partly among the policyholders is the excess of the earnings over the expenses incurred in earning that excess. The sum that goes to the shareholders is one-third, and two-thirds go to the policyholders, and both so go by virtue of contracts with the Company. It is true that one-third goes to the shareholders because they are shareholders, and two-thirds go to the policyholders because they have contracted without being shareholders. But contract is at the bottom of the whole distribution. I cannot see any distinction between the two portions of the fund. Both are profits made by the Company; it appears to me that the view taken by Smith, J., in the Court below is correct.

Appeal dismissed.

HOUSE OF LORDS.

WILLIAM HARRISON LAST (*Surveyor of Taxes*) . Appellant,

and

THE LONDON ASSURANCE CORPORATION . . Respondents.

APPEAL FROM AN ORDER OF THE COURT OF APPEAL.*

The only question raised on the present appeal was whether the sums payable to participating policyholders were liable to income tax.

During the argument their Lordships asked to see the Respondents' prospectus. That for 1880 was handed in. It contained tables of premiums both "with" and "without participation of profits"; and also the following clauses:

"The bonus to the assured is increased owing to the arrangement "by which, in consideration of a fixed percentage of the *gross* profits "of the life assurance business, the Corporation bears all the expenses "of management."

"Division of profits:

"Two thirds of the gross profits of the participating series of "policies are allotted every five years to the assured, every policy in "force at the date of the valuation being entitled to participate. The "assured have the option of receiving their share of the profits in "cash, or of appropriating it in increase of the sum assured or in "reduction of the future annual premiums."

June 8. Sir *H. James*, A.G., and *A. V. Dicey*, for the Appellant:

The question is what are the "profits" of the life insurance business? The Appellant's contention is that the sums paid to policyholders in the shape of bonuses were assessable income or revenue: the Respondents contend that the only profit of the Corporation available for division among the shareholders is the surplus that remains

* 14 *Q.B.D.* 239.

after paying the bonuses and the expenses of the business, and that this is all that is liable to income tax. "Profit" is the excess of receipts over expenditure. The fact that this surplus is applied in any particular way does not make it cease to be profit. The only question is whether the part of the surplus devoted to the policyholders is to be considered as profit. The tax is levied under Schedule D of 16 & 17 Vict. c. 34, and the rules are in 5 & 6 Vict. c. 35, s. 100, and the concern brings in a profit to somebody. The Respondents' own accounts specify the "portion of *profits* appropriated to shareholders." Under the Income Tax Acts receipts are taken to be profits though they might not be regarded as profits by men of business: Mersey Docks *v.* Lucas.* Whether the appropriation is under contract, as in this case, or by statute, as in that, makes no difference, and the motive of the appropriation cannot alter the character of the surplus. The test is this: if there is an expenditure which would be made in any case, from which profits may accrue, that expenditure should be deducted; but an expenditure which will not be incurred unless there is a profit is not an expenditure in order to earn a profit.

[Lord Bramwell:—If your contention is right the participating policies are more profitable than the others; for the premium is higher, and you say that the bonus is not an additional expense.]

The profits are not only made from the premiums but in other ways, for instance from investments. A percentage of profit paid to a workman is to induce him to do work by which the profit is made.

Sir *H. Giffard*, Q.C., and *Arthur Charles*, Q.C. (*A. P. Stone* with them), for the Respondents:

The policyholder is not a co-adventurer. If a book is published on the system of "half profits" the publisher only pays income tax on the half. The "surplus," of which a share is paid to the participating policyholder, is not (correctly speaking) a "profit" of the Company, and the word "profits" in the prospectus is not used in the sense of "net profits." It is merely used to describe a fund which, subject to certain deductions, is to serve as a measure of payment to the policyholders. The consideration for the increased premium is two-fold, a fixed payment on the death of the policyholder and another payment contingent on the amount of the surplus.

[Lord Blackburn:—The question is, for what does the participating policyholder pay the higher premium? Is there not an agreement to pay him a share of the profits?]

The higher premiums create a fund which, by contract, is to be given back to the policyholders. The Company are bound to pay the bonus, by virtue of their contract, for the purpose of earning the fund, as was put by Day, J., in his judgment in the Court below.

Dicey, in reply:

A deposit account at a bank shows the difference between interest and a share of profits. The question is not, What is the consideration

* 8 App. Cas. 891.

for the payment? but, What is the fund from which the payment is made?

[He also referred to 5 & 6 Vict. c. 35, s. 102.]

The House took time for consideration.

July 14. LORD BLACKBURN:

My Lords, the Appellant is a surveyor of taxes. He appeals against an order of the Court of Appeal, confirming an order of the Queen's Bench Division made on the 14th day of March 1884. That order is as follows:—"Whereas in pursuance of the 9th section of the "'Customs and Inland Revenue Act, 1874', a case had been stated, "at the request of the above Appellant, for the opinion of this Court "by the Commissioners for the general purposes of the Income Tax "Acts for the City of London, and whereas the said case came on to "be heard on the 13th day of March instant, when upon reading the "same, and hearing Sir Henry James, Knight, Her Majesty's "Attorney-General, for the Appellant, and Sir Hardinge Giffard, "Knight, Q.C., for the Respondents, and the said Attorney-"General in reply, the matter was adjourned for judgment until "this day. Now the Court are of opinion that the decision of "the said Commissioners discharging the assessment made upon "the Respondents is correct, and affirm the determination of the said "Commissioners, and do order that the costs of said Respondents "of this appeal be paid to them by the said Appellant. And it is "hereby referred to the Queen's Remembrancer to tax such costs."

By 37 Vict. c. 16, s. 10, it is required that "the Court shall deter-"mine the question or questions of law arising on a case transmitted "under this Act, and shall thereupon reverse, affirm, or amend the "determination in respect of which the case has been stated, or remit "the matter to the Commissioners with the opinion of the Court "thereon, or may make such other order in relation to the matter, "and may make such order as to costs, as to the Court may seem "fit."

The appeal from the Queen's Bench Division to the Court of Appeal, and from the Court of Appeal to this House, was intended to raise one question only. The case as stated under 37 Vict. c. 16 by the Commissioners for the general purposes of the Income Tax Acts for the City of London, I may, I think, say is not, without explanations and additional information, to me at least intelligible. But the Appellant, the surveyor of taxes, who in this case represents the Crown, and the London Assurance Company, did furnish such explanations and information to the Queen's Bench Division as enabled the learned judges to think that they understood what were the questions of law arising, or at least intended to be raised, on the case. These were, in the opinion of the Court, four; on three of them the two judges agreed, and on those there has been no appeal, and this House has nothing now to do with them. But on the fourth question the two judges differed. They both, I think, agreed that if the Corporation was liable to pay income tax on only one-third of the sum ascertained quinquennially as being the profits during that five years, which was divisible among the shareholders, the decision of the

Commissioners was right and should be affirmed; but that if the two-thirds which were distributable amongst the holders of policies with participation of profits, whose policies were at that time still in force, were to be treated as part of the profits for which the Corporation were liable to be assessed, the decision of the Commissioners was not right. Smith, J., as being the junior judge, withdrew his opinion, and the order of the 14th of March 1884 was made.

I think on the appeal to the Court of Appeal, and also on the appeal to this House, it must be taken as agreed by both parties that this was the only question. And I think it must also be taken as agreed by both parties, that a scale of premiums is in force, supposed by the Corporation to be such as persons desirous of insuring their lives would be likely to accept, which were such that the Corporation, if getting a sufficiently large number of policies to make the average of lives dropping in each year pretty constant, would expect to make a fair profit; and a higher scale of premiums was also in force on which policies were issued "with participation in profits."

If the ordinary premiums were such as to lead to an expectation of a fair profit, the higher scale of premiums would lead to the expectation of a large profit. But no one who could insure at the lower rate would insure at the higher rate unless he got some inducement to do so. And I think we must take it as agreed by both parties, that the bargain (so made as to be binding on the Corporation, and enforceable against them by those who took participating policies) was that the holders of such participating policies as were in force at the quinquennial period should have paid to them two-thirds of the profits made during the five years on this class of participating policies. Each individual policyholder who thus acquired a right enforceable at law has an option to take his part in cash or in some other way. I do not think that material. The Corporation keeps only one-third.

The inducement for the Corporation to agree to take only one-third is, I think, obvious. They receive premiums on this high scale during the five years, and, unless some very unusual mortality occurs amongst their participating policyholders, will receive a large profit. They cannot be called upon to make any payment to the policyholders unless there is a profit, and therefore, being in all probability secure against loss from making this payment, may very reasonably prefer a smaller share of the large profit which is expected on policies of this class to the whole profit on ordinary policies on which there might be a loss.

A person who is about to take out a policy may, if he is of the age of twenty next birthday, insure, according to the tables of the Corporation £100 for his whole life, without participation in profits, at the annual premium of £1. 13*s.* 2*d.* He may, if he prefers it, insure the same sum, with participation in profits, for a premium of £1. 19*s.* 10*d.*, or 6*s.* 8*d.* more. What has he by the bargain stipulated he shall have in consideration of this extra 6*s.* 8*d.*? If he dies before the quinquennial period arrives, he gets nothing; but if his policy is still in force, he has, I cannot but think, purchased a share in the profits, if any, earned during those five years. If there are no profits he gets nothing. If this is the right view of the case, income tax is

payable by the Corporation on those profits, whatever they may be bound to do with the profits. Not only has this been decided, I think, by this house in the Mersey Docks *v.* Lucas,* but it seems to me expressly enacted by 5 & 6 Vict. c. 35, s. 54, which requires the estimate of the profits of a corporation to be made "before any dividend shall have been made thereof to any other persons having any share, right, or title in or to such profits."

Cotton, L.J., says, indeed, that "the word 'dividend' clearly, in my opinion, means what is to be divided between those who claim it not by their contract with the company but by their position as shareholders." I have great respect for the judgment of Cotton, L.J., but he gives no reason for this construction of the enactment, and I can see none. I feel bound to say that I do not agree in it. I think if the policyholders have purchased a share in the profits, they are persons having a right to a share in the profits; but the great question is whether what the policyholders are entitled to is a part of the profits. The three judges below, from whom I differ, have thought that what was by the bargain to be given to the shareholders was not a share of the profits, but an expense necessarily incurred in order to earn the premiums and therefore to be deducted before the profits could be ascertained.

I have been unable to agree with this opinion. The Master of the Rolls seems to think that in estimating the profits of a business you must always, as he words it, "consider the shareholders and the customers in antithesis." As I understand this figurative expression, he seems to think that whatever is by the bargain to be given to the customer must be an expense preliminary to the earning of profit, and cannot be itself a part of the profit. I rather think it was from (I cannot but think hastily) assenting to this position that Cotton, L.J., put the construction from which I have dissented on 5 & 6 Vict. c. 35, s. 54. I agree that many things which by bargain are to be given to a customer are really expenses incurred to earn the profit; and I think it would make no difference if by mistake they were called profits. For instance, I should not hesitate to say that if the bargain was that whenever a policyholder had paid premiums for five years, the extra premiums (that is, in the case of the life of twenty, the six shillings and eightpences) paid by him, or some part of them, should be returned, that could in no way be a share in the profits. It would be returned whether there were profit or not. But I cannot agree in what seems to run through the judgments of all three judges from whom I differ, namely, that no share in profits can by bargain be given by a company to anyone who is not a shareholder.

I believe that the majority of your Lordships agree with me, and I therefore move that the order appealed against should be reversed, and the order of the 14th of March 1884 varied by remitting the case to the Commissioners, with a direction that the profits of the life branch should be calculated on the principle, that whatever profit was made should be assessed, though the Corporation had bound themselves to pay it, or a part of it, to the policyholders whose policies were still in force at the quinquennial period; and also that the order of the

* 8 App. Cas. 891.

14th of March should be varied by giving no costs to the Respondents in the Court below. And I think that the Appellant in this case should have the costs in the appeal from the Queen's Bench Division to this House.

Lord Bramwell:

My Lords, I am of opinion that this judgment should be affirmed.

Income tax is payable by the Respondents on their profits, and the question is, what are those profits? The profits of a business are what remains, if anything, after deducting all outgoings from all income. Of course, in outgoings many things must be included which that word inadequately describes, but the consideration of which is immaterial to the question before us. If profits are made in the business which the proprietors choose to give away, they must nevertheless pay income tax on them. But if, in order to earn what would otherwise be net profits, they are put to expense, or liability to expense, which must be deducted from what is called gross profit, then they are liable only in respect of what remains after deducting such expense or liability. Take the common case of a commission payable to the person who brings business to the insurance company; before the profits of the company can be fixed, his commission must be deducted. In short, it may be said that income tax is payable on that which is divisible among the shareholders.

The fallacy in the argument of the Crown arises from the inaccurate, though practically convenient, use of the word "profits", as meaning the gross profits, *i.e.*, profits without deduction of outgoings. As Jessel, M.R., said, "There is no such thing as 'gross profits.'" If the expression had been not "participation in profits", but "a return or benefit equal to two-thirds of what would be profits but for the obligation to make such return or benefit", there would not be the least ground for the claim even in appearance.

Let us see what is the difference between the two classes of insurance, the participating and non-participating. The ordinary insured, *i.e.*, the one not entitled to any return or benefit beyond the sum insured, pays at fixed interval during his life a sum which, it is calculated, if laid out at compound interest, will produce such a sum as, after paying expenses and the sum insured, will leave a fair profit to the shareholders.

The insured entitled to a return of premium or benefit beyond the sum insured does precisely the same thing. He pays at fixed intervals during his life a sum which, it is calculated, if laid out at compound interest, will produce such a sum as, after paying expenses and the sum insured, and two-thirds of what, but for the obligation to pay it, would all go to the shareholders, will leave a fair profit to them.

It seems to me that the case may be demonstrated thus: it cannot be said that, where a sum is added to the policy or the future premium is diminished, there is a profit to the insurers, unless it can be said that there is such profit where money in ready cash is paid to the

insured. Now is there such a profit to the insurers where cash is returned to the insured? I say, clearly not. Suppose a bargain was made with the insured thus: You shall pay such and such a premium, and if we want money to pay our liabilities and make a profit divisible among shareholders, you shall pay so much more. In that case, would the insurers be making a profit, the amount of which would include the amount of the additional obligation of such insured? Certainly not. But there is no difference between that case and the case of those who are to have some return of premium made or benefit given, save that in the latter case the insured trusts the insurers to make the return, while in the former the insurers would trust the insured to make the payment, which of course would be less convenient. In such a case as I have supposed, the insured would pay less at the outset than the premium in the case where there is to be no return or benefit beyond the sum insured. He would do so because in certain events he would be liable to pay more. As it is, where he is to have that contingent return or benefit he pays more because he is to have it. Take the two cases. A. pays £2 a year to insure £100, and he and the insurers agree that, if they do not want all of it to pay outgoings and leave them a profit, they will return him 10*s*. a year. B. pays 30*s*. a year to insure £100, and he and the insurers agree that, if the insurers want it to pay expenses and leave a profit, he will pay another 10*s*. a year. What is the difference between the two cases? But, if in the latter case the liability to pay 10*s*. is not part of the profits, how in the former is the receipt of the 10*s*. with the liability to return it? The "profits" are calculated quinquennially and not annually on account of the trouble and expense of the calculation, but suppose they were calculated annually and an annual return made to the insured, could it then be said that the sum so returned was part of the annual profits?

No doubt the insured, who is to have a return of premium or bonus, is interested in the prosperity of the business. But that is not the question. The question is, what are the profits of the Company? The insured, who in the case I have put would have to pay a further premium, would be interested in the profits of the Company, but certainly his liability to pay would not be counted in the profits. Nor does the insured make a profit if he has this bonus or return of premium. If he has a return of premium, his insurance costs him less than it would otherwise. If a bonus is added to his policy, he has a larger sum insured than he had before, a contingency for which he bargained when he insured. But, further, the question is not whether the insured has made a profit, but again, whether the insurers have. On a marine insurance, the insured may receive more than his loss. That does not show profit in the Company.

As I have said, the whole difficulty, the very existence of the question, has arisen from the inaccurate use of the expression "participation in profits", instead of "participation in the sum that would be profits but for the right to participate."

The matter may be illustrated thus: If the Crown is right, who will pay the income tax on the whole three-thirds? The shareholders? If so, they would pay on profits they do not receive. The

participating assured? Then they would pay income tax on something which is not within the Income Tax Act.

The question is very important. As far as insurance companies are concerned, all they will have to do will be to alter their language. But if the contention of the Crown is right, income tax will be payable in all cases in which employers have agreed with employed that, besides fixed wages, the employed shall receive what is called a share of the profits. The income tax will apply to co-operative societies strictly so called, and be payable on a sum falsely called profits, with no deduction of the wages contingently payable to workmen, if gross profits enable them to be paid. This Mr. Dicey in effect admitted. I think it would be most disastrous, and most unreasonable. As much so as if a man gave £1 to a fisherman to go fishing, and a tenth of the fish, or a tenth of what remained of the price of the fish after deducting for the boat, &c., and then was charged to the income tax without deduction for the fish given or allowance made to the fisherman.

I cannot truthfully say I have the least doubt in this case, except that which arises from my respect for the opinions of other noble and learned Lords.

Lord FitzGerald:

My Lords, I should have found it very difficult to eliminate from the case stated the question for your Lordships' decision if it had not been for the light afforded by the judgments in the Divisional Court and Court of Appeal. It was admitted, as I understand, in the course of the argument, that your Lordships' decision on the one question before you must largely, if not entirely, depend on your Lordships' interpretation of the contract between the Company and the holders of policies of the participating series. The participating policy is in the ordinary form with nothing to indicate its special character, but the true agreement is to be found in the printed prospectus of the Company under the head of "life department." "Division of *profits. Two-thirds of the gross* profits of the partici-"pating series of policies are allotted every five years to the assured, "every policy in force at the date of the valuation being entitled to "participate. The assured have the option of receiving their share *of* "*the profits* in cash, or of appropriating it in increase of the sum "assured, or in reduction of the future annual premiums." In the preceding page of the prospectus, but under the same heading, the following passage occurs:—"The bonus to the assured is increased "owing to the arrangement by which, in consideration of a fixed "percentage of the *gross* profits of the life assurance business, the "Corporation bears all the expenses of management."

I am not to be understood as resting my judgment on the use of the term "profits," though it is not to be put out of consideration, but I had rather examine into the substance and reality of the agreement. It would be difficult to arrive at a construction of this portion of the prospectus without some extraneous aid; but it has been assumed in the argument that the participating policy entitled

to a share in two-thirds of the gross profits at the time of the quinquennial distribution must be then in full force and have been so for the preceding five years. If it has lapsed or from any other cause, as for instance the death of the assured, has come to an end within that period, there is no claim to participation; and if it has not reached five years of age the holder must wait for the distribution at the end of his first term of five years. The question is whether the company is liable to pay income tax in respect of that portion of its annual receipts which it designates as "two-thirds of gross profits", and quinquennially allocates to the participating policyholders who at each distribution may come within the terms of the prospectus. I have been unable to reach the elements which are taken into the calculations of the Company for the purpose of ascertaining what is termed the "two-thirds of gross profits" at each quinquennial allocation. The amount varies, and on the first example given in the prospectus it would seem that it necessarily varies according to the mode in which the benefit is claimed by the recipient; thus, in the example so given, if he claims to have his share added to his policy the accretion may amount to £66. 8*s*., being two-thirds of what he has paid during the five years, but if taken in cash the bonus in cash is but £24. 17*s*. That example, I presume, represents a period without exceptional loss. But it may be that the losses are such as to extinguish profit on the five years, and there could then be no allotment, or to reduce the profits and the allotment accordingly. It does not represent any proportion of the actual receipts from this class of the company's customers though it may approximate to it. 16 & 17 Vict. c. 34, sched. D., imposes income tax on "the annual "profits or gains arising or accruing to any person from any profession, "trade, employment, or vocation." We are bound to adopt the interpretation put on "profits" in the Mersey Docks *v.* Lucas,* that the expression means "the incomings of the concern after deducting the expenses of earning them", or "income of whatever character it may be over and above the costs and expenses of receipt and collection", and that "the gains of a trade are what is gained by the trading for whatever purpose it is used." On looking again at the prospectus, page 4, where the income of the Company is given for the year 1880, it will be found that under the head of "income for 1880" the first item is "life premiums £149,160. 1*s*.", in which no doubt the whole sum received in respect of life policies, including the participating series, is put down as annual income.

The judgments of Day, J., in the Divisional Court, and of the majority of the Court of Appeal, rest on the ground that the sums allotted to the participating policyholders under the name of two-thirds of the gross profits for the quinquennial period are to be treated as an expenditure made to get the customers to come in, and not an annual profit chargeable with income tax under the Income Tax Acts. After careful consideration, and with every desire to reach the same conclusion, I have been wholly unable to do so. The premiums payable by the participating policyholders come into the coffers of the

* 8 App. Cas. 891, 903, 904, 905, 912.

Company quarterly, half-yearly, or annually in ordinary course and form part of the annual income of the concern. When received those moneys are probably invested, the profit of the investment also forming a part of the income; and I cannot see that they the less form part of its annual income because at a subsequent period of time a part of the gross profits (if any) realized may be allotted to certain of the policyholders. It seems to me, on the contrary, to be annual "income" after deducting the proper expenses of earning it, and subject to income tax notwithstanding its subsequent special destination. The prospect of a future participation in profits is held out as an inducement to customers to insure in the participating series, and probably has proved to be successful, but it seems to me to be a very forced interpretation of the contract and position of the parties to put it down as part of the expenses of making the income.

No one could truly say, after the judgment of my noble and learned friend (Lord Bramwell) that the case is free from doubt. I agree with him that the question we have to decide is one of importance, but I am unable to follow him in thinking that the decision which your Lordships are arriving at is to produce the extensive results which he has pointed out.

The conclusion I have reached on the case as it comes before us, and not on any supposititious case, is that the premiums paid to the Company in respect of the participating policies form part of the annual profits of the Company just as much as any other portion of their revenue, and that the quinquennial allotments represent no return to the policyholders of any aliquot proportion of the premiums they have paid, but do constitute what the parties have correctly described as a participation in two-thirds of the gross profits, if any, realized in the quinquennial period.

Order appealed from reversed. Order of the Queen's Bench Division varied by remitting the case to the Commissioners, with a direction that the profits of the life branch should be calculated on the principle that whatever profit was made should be assessed, though the Corporation had bound themselves to pay it, or a part of it, to the policyholders whose policies were still in force at the quinquennial period, and by giving no costs to the Respondents in the Queen's Bench Division; the Appellant to have his costs in the appeal from the Queen's Bench Division to the Court of Appeal, and in the appeal to this House. Cause remitted to the Queen's Bench Division.

Lords' Journals, 14 July 1885.

State Supervision in Insurance.

[Abstracted from a paper read by Mr. Richard Teece before the Insurance Institute of New South Wales, on 8 July 1885.]

THE principle of *laissez faire,* or of non-intervention by Government in the affairs of people over whom it rules, probably finds more general acceptance among Anglo-Saxon communities than in those of any other nation. The general acceptance of this doctrine would appear to be a legitimate conclusion from the logic of experience; no nation, ancient or modern, has exhibited so large a capacity for self-government as our own; and the authorities who have, throughout its history, controlled the destinies of our race have wisely fostered and encouraged the growth of this capacity. And it cannot be matter for aught but congratulation, that enterprises for the successful conduct of which the individual has shown himself capable have suffered but slight interference, and have been opposed by but few obstacles on the part of the State. There is, however, a point at which non-interference becomes neglect; and it is the duty, as it is the characteristic, of the prudent ruler to avoid as well the Charybdis of culpable neglect as the Scylla of unnecessary interference. The great question is to find the point at which the limit of the functions of Government should be placed; this, I venture to say, can only be learned from the teaching of experience. The aim of British rulers—in our day at least—in this matter has been to provide that while no enterprise shall be checked by needless restrictions, it shall not be prosecuted in concealment; that while it shall be allowed to shape its own course, and pursue its own career, it shall leave beacons along its path, in order that those who are in search of it shall be able to find it; that while it shall be permitted the full exercise of the capacity to conceive and the ability to execute whatever designs may appear necessary to its development, it shall not execute (however much it may conceive) anything which shall be prejudicial to the State or injurious to the interests of the people committed to its care. In short, that anything which is attempted or accomplished shall be done not under cover of night nor out of sight of the community, but in open day, with the sunlight of public opinion illumining its every ramification. I shall confine myself chiefly if not entirely to life assurance, and the line along which I propose to proceed, is to present you with a *resumé* of what has already been done elsewhere

in this matter of legislation, and then to indicate what I think are the principles upon which legislation should be based.

It will be convenient to adopt somewhat of a chronological arrangement, and I shall therefore first invite your attention to a consideration of my subject as it relates to the United States of America. In that country there are at present, so far as I can discover, no less than 43 States and Territories, each one of which has an insurance code of its own, and probably four out of every five of these codes are annually subjected to such an amount of tinkering by ambitious and generally incompetent legislators, that the average student of insurance literature shrinks in despair from the attempt to familiarize himself with them. In the words of the editor of the *Spectator*, in the introduction to his Year Book for 1884, "These laws "are as varied as the ingenuity of State legislation could make "them, incongruous, inharmonious, and in some instances un-"constitutional, as has been declared in the highest State Courts. "Still, as long as they remain unrepealed, or until a national code "of insurance laws supersedes them, they must be observed." Although there were in many of the States laws relating to insurance and to the control of insurance companies dating back as far certainly as fifty years ago, there seems little doubt that the principles underlying the existing enactments (and the cardinal principles are common to all) were first fully embodied in the Massachusetts code, about 1855 or 1856, and owed their existence to the Hon. Elizur Wright. In saying this, I do not overlook the fact that a year or two earlier, the laws of New York were so amended as to require from insurance companies full and complete returns of their business. But it is to Mr. Wright and to Massachusetts that we must look for the introduction of the principle, the cardinal one as it seems to me in American legislation, of a valuation by the State, in the person of its commissioner or superintendent, of the assets and liabilities of the companies doing business within its jurisdiction. Without going into details, which are not necessary for my present purpose, I may broadly indicate the general principles which are embodied in the insurance statutes of the United States. In each State the business, under all branches, is under the control of an Insurance Department, at the head of which is a superintendent or commissioner; there is no fusion of all branches—fire, life, marine, &c.—in one company, as with us, but a life assurance company is prohibited from transacting fire or marine business; before com-

mencing to transact business—a company must make a deposit (generally of $100,000, say £20,000) with the superintendent; in some cases separate deposits have to be made in several States; each company has to render a very full annual return of the business transacted; the money received and disbursed, the securities in which its assets are invested, and a statement of its financial condition. The superintendent is required and directed to make a periodical valuation of the assets and liabilities of each company, and, if the result of the valuation warrants it, to issue a certificate of solvency, which alone is the company's authority to transact business. The various enactments provide what standards shall be employed in valuing the liabilities of the company; the awkwardness of this, however, is that the States cannot agree under what conditions a company can be said to be solvent. The standards of valuation range from the "Experience table" with 4 per-cent interest in Massachusetts, to the "American table" with 6 per-cent in Minnesota; so that a company which might be perfectly solvent in the latter, might be hopelessly bankrupt in the former. In the event of insolvency (or impairment, as it is sometimes euphemistically termed) the company is placed in the hands of a receiver, and where the carcase is, there do the eagles gather together. What a good equity suit is to the lawyers of our own country, a life company in the hands of a receiver is to the lawyers of the United States. Two of the largest American companies—the Continental and the Life Association of America—went into the hands of receivers in 1876 and 1878 respectively, and they are still there.

The companies are further compelled to pay an annual tax on the premium income, ranging from 1 per-cent in Georgia to 3 per-cent in Alabama. Besides these, which may be called general provisions common to most of the States, there are others which appear to be peculiar to a few. For example, in the State of New York there is a severe restriction as to the investment of the funds of a company. Of this class of special provisions, too, is the celebrated Non-Forfeiture Law, which was first introduced into the Massachusetts laws in 1861, and amended in 1880, copied by Maine in 1877, by New York in 1879, and which is, I believe, also in operation in California, Colorado, and Missouri. Of course, the provision differs in detail in the different States.

The great point to notice in this provision, is that by its means the policy may be kept in force for a certain number of years, at the end of which time it must lapse; it confers no power on the

policyholder to pay up his arrears of premium and re-instate himself in his original position—that cannot be done under this law. Besides which, in the event of death, premiums which could not be held to be rightly due by the policyholder are deducted from the amount of the policy. This clause was amended in 1880, and a paid-up policy substituted for the temporary assurance —a great improvement on the old law, but still a long way behind our method. By the amendment of 1880 the right was also given to the policyholder (when all insurable interest in the policy had terminated) to receive the surrender value in cash. The Maine Enactment of 1877 is similar to the Massachusetts one of 1861. The New York law of 1879 gives the policyholder the option of either of the Massachusetts provisions of 1861 or 1880. One point to be observed in connection with these laws is that in many cases there is one law for companies chartered by the States and another for companies of other States transacting business in it. For example, the Massachusetts Non-Forfeiture Law applies only to companies chartered by that State; and as, I believe, there is only one such company in existence, there is not much room for the operation of this much-lauded improvement. Under this law the representative of Massachusetts insurance cannot issue tontine policies, but the companies of other States can issue such policies to Massachusetts citizens. This is protection to native industry turned upside down. I must not omit to mention that many companies in America incorporated this non-forfeiture provision in their policies before they were compelled to do so by legislative enactment.

In considering the history of insurance legislation in America, one cannot fail to be struck with the hostile attitude assumed by the legislatures towards the companies. One would think that life (and indeed all) insurance companies, which are admittedly capable of conferring the highest benefits on the community in which they exist, would commend themselves to the tenderest solicitude on the part of the State; but in America insurance companies are compelled to be constantly on the watch to defeat some act of aggression or some attempt at spoliation at the hands of ignorant, malicious, or disappointed legislators. We who are accustomed to the almost perfect liberality of the life policy, look with astonishment on the conditions with which the contracts of American companies are burdened, but we must not lose sight of the oppressive restrictions and the harassing conditions which a paternal legislature has imposed on them, and which have left

them but little scope for the exercise of their own freedom. But while the State legislatures are thus openly hostile, the companies find a warm friend in the State Court. The State Courts invariably uphold the companies in exacting their pound of flesh. I confess I cannot contemplate some of the decisions of the American law courts without a strong conviction that the policyholders are hardly dealt by.

Let us, however, ask, does it appear that the legislation of America has realized the expectations formed of it? Does not the list of insolvencies at once answer in the negative? It is no argument to the contrary to say that a much larger and more disastrous list can be compiled from the history of British companies. We shall see later on that while the insolvencies of British companies have been largely rendered possible through the absence of legislation, those of American companies have arisen in the face of legislation, which was specially devised to render such catastrophes impossible, or, at most, of very unfrequent occurrence. British companies have collapsed as the result of many years of shameful mismanagement; but the American companies received from the superintendent certificates of solvency year by year up to the very date of their failure, and we know well enough that an insolvent life company is not the mushroom growth of a single night, but the development of many years of retrogression. The result of American legislation has been to lull the public to sleep, to lead it to trust implicitly in a system which only pretended to give security, and to take away from the people the incentive to observe, to examine, to scrutinize for themselves. Theoretically, this legislation is based on sound principles—practically it has proved to be rotten. It is worthy of remark, also, that we look in vain throughout the mass of returns furnished by American companies for the information which is to be found in the valuation summaries of the English and Colonial Acts.

Let us turn now to Great Britain: and here we must confess that it required a severe experience to galvanize British legislators into action. There are a few very sad pages in the history of British life assurance, but it required the scandalous collapse of the Albert and the European to convince the long-suffering British public that it needed some protection from the rascality of the knaves who had so long fattened on its credulity. The failure of these two offices led to the passing of the Life Assurance Companies' Act of 1870, which, with the Amending Acts of 1871 and 1872, is at present the law by which life companies are controlled

in England. The leading principle of the English Act is in direct opposition to that to which I have alluded as the chief characteristics of American legislation. The latter, as I have shown, aimed at placing information in the hands of a State official, to whom the public were taught to look for protection. The English Act, on the contrary, aims at compelling the companies to make public this information, and then leaves the people to decide for themselves as to the solvency or otherwise of the corporations. America in effect declared that the people could not be trusted to discriminate for themselves; England, on the contrary, said, "give the people the information necessary to enable them to "judge, and leave everything else to the force of public opinion, "moulded by the criticisms of a free and unfettered press." I think (as far as this general principle is concerned) the results have fairly justified the anticipations of the authors of the English Act. Most of the unsound companies have been weeded out; a few which still remain and which are dying hard, are nevertheless dying, and I do not think it possible for any large company in England, at the present day, to collapse suddenly as did the Continental of the United States.

Under the provisions of the English Act, no company can commence business until it has deposited £20,000 with the Government as a guarantee of its *bonâ fides*. Every company is required annually to make returns of its receipts, disbursements, and assets, similar to those required under the American Act, although I am free to confess that, in regard to the last-named, a closer imitation of the American demand would be advantageous. The English Act does not require sufficient information regarding the assets of the companies. There is nothing in the Act to prevent a company inflating the values of its securities, and in this I see a possible source of danger. It is to what are known as the Fifth and Sixth Schedules (the valuation schedules) of the Act that we must look for the most valuable service rendered by it. These schedules give particulars regarding the policies in force which will enable any one skilled in the science of life contingencies to arrive at a very close estimate of what the liabilities of an office are. While prescribing no particular standard of valuation, it requires full and explicit information regarding the standard adopted. The one great blot in this part of the Act is that it does not compel a company to state the values of its net premiums. This omission will, I have no doubt, be supplied in any future amendment which may be made in the Act. The Act contains

provisions for dealing with companies which may become insolvent, but, unlike the American Acts, it does not say what constitutes insolvency. Herein lies the great difficulty which confronts us in legislating for insurance companies. Those who are accustomed to follow the discussions in the English insurance press and in the Institute of Actuaries, will be fully convinced that there is no question on which greater difference of opinion exists than that on the point at which the line between solvency and insolvency is to be drawn. But if the English Act does not solve this question, it at least embodies a valuable provision which can be brought into operation when once the question has been settled. Under the American Act, as I have said, when a company is found unequal to the standard of solvency laid down, it is put straightway into the hands of a receiver, under whose care it passes during some years through an ordeal of spoliation, and finally yields either nothing at all, or at the best, very homœopathic dividends, to the policyholders. Under the English Act it is in the power of the Court, instead of ordering the insolvent corporation to be wound up, to reduce the amounts of the policies and to make provision for carrying the company on in such a way that there shall be no unnecessary waste of its resources. I look upon this provision as a most valuable one. The Act also contains provisions for the amalgamation and transfer of companies, and in connection herewith a regulation as to novations by policyholders, by virtue of which a policyholder in a company which has been transferred to another, does not abandon any claim he may have against his original company, unless he has specifically consented in writing to do so. The English Act contains no provisions regarding assignments of policies, protection in case of insolvency of policyholders, nor policies effected by married women; the first and last named of these are dealt with under separate Acts, and I shall defer any further reference to them until I have briefly dealt with the Colonial Acts. Of these there are five, namely:

* The New Zealand Act of 1873 with Amendment of 1884.
* The Victoria Act of 1873.
* The Tasmanian Act of 1874.
The Queensland Act of 1879.
* The South Australian Act of 1882.

* An account of the New Zealand Act of 1873, and the Tasmanian Act of 1874, will be found in Vol. xx (p. 441). The full text of the Victoria Act of 1873 is also given in the same volume (p. 59). The text of the South Australian Life Assurance Companies Act of 1882 will be given in an early number.—ED. *J.I.A.*

I may at once dismiss the Queensland Act from consideration. So far as the general principles which should distinguish all such enactments are concerned, this statute is a solemn mockery; its author was evidently lamentably ignorant of the subject with which he was dealing, and the Queensland Government will consult its own dignity by erasing it from the Statute Book with all convenient speed. Some details of the Act will be dealt with by way of comparison later on. Of the other four Acts, those of Victoria and Tasmania leave it optional with the companies already in existence whether they shall register under them or not, and herein I think a mistake has been made. In regard to these four Acts, it will be convenient if I state first the provisions which are more or less common to all:

1. They all require a deposit of £5,000 before a company can commence business.

2. They all require information regarding receipts, disbursements, and assets similar to that demanded by the English Act, with the following modifications:

(*a*) The New Zealand and South Australian Acts require the item of commission in the revenue account to be divided, showing separately the amounts paid for new and renewal business. This is a very valuable provision, although it is open to evasion.

(*b*) The Victorian, Tasmanian, and South Australian Acts require the assets in the particular colony to which the Act relates stated separately in the balance sheet.

3. They all adopt the English form of valuation schedule, with the following modifications:

(*a*) The South Australian Act requires the values of the net premiums to be stated, and is, as far as I am aware, the only existing life act which does so.

(*b*) The Victorian and Tasmanian Acts require the liabilities in respect of policies in the particular colony stated separately from those of the remainder of the business. If the distinction here pointed out be looked at in connection with a similar distinction in the balance sheet to which I have called attention above, it will no doubt appear that there was some hazy idea in the minds of the framers of the Acts, of making the one complimentary to the other; of making a provision

by which the assets which a company held in the colony should bear some relation to the liabilities under the policies in that colony. I am confirmed in this opinion by the fact that under each of these Acts (and the one is a very close copy of the other) a company may (but this is purely optional) be registered as a company, having "secured assets" in the colony. It may then deposit such securities as it deems fit with the Registrar-General, and securities so deposited are primarily charged with the payment of the liabilities in that colony, and cannot be removed as long as any liabilities remain. Without stopping to discuss whether such a provision is *ultra vires,* I would point out how utterly meaningless it is, unless it be compulsory on a company to deposit from time to time securities equal to the value of the liabilities in the colony. To avoid any misconception I may say that, personally, I should regard any such compulsion as highly obnoxious and tyrannical. I cannot spare time now to give my reasons for this opinion, but I am prepared to do so should occasion arise.

4. All except the New Zealand Act require a statement of the existing business under different classes, shown separately for the colony and elsewhere.

Thus far the schedules are fairly uniform, but the South Australian Act goes beyond this in a direction which, for the general purposes of life companies, places it far in advance of any other statute with which I am acquainted. It requires a complete statement of the policies issued and void under the various classes of assurance, both for the particular year and for the whole period of the company's existence. It requires full particulars of the principles adopted in valuing the policy liabilities—so full, indeed, that the real position of the company can be ascertained within very narrow limits by any skilled person outside the office.

5. All the Acts contain the provisions for transfer and amalgamation, and the regulations as to novations by policy-holders.

6. They all contain the provisions (similar to those in the English Acts) regarding the treatment of insolvent companies, with the startling exception that the New Zealand Act (following the example of America) has fixed the standard of solvency.

Section 35 of the Act of 1873 says:—"Any company registered "as aforesaid may be wound up by the Court . . . upon its "being proved to the satisfaction of the Court that the actual funds "of the company are not of a net cash value equal to its liabilities, "counting (as such) the net value of its policies according to the "Combined Experience or Actuaries' rate of mortality, with "interest at 4 per-centum per annum." I notice that even the phraseology of the American Acts is used in this clause. Do we fully recognize what this means? It means that there are at this moment companies doing business in New Zealand that would stand a very good chance of being wound up if this Act were enforced. Why, the New Zealand Government Insurance Association itself has its liabilities valued at 4½ per-cent, and what shall we say of a Government which, while it compels other companies to pay 20*s.* in the £, is quite content that itself shall be asked to pay only 17*s.* 6*d.*! Yet this is what the section means if it has any meaning at all.

7. The South Australian Act and the New Zealand Act (by the amendment of 1884) contain a clause compelling the offices to apply the surrender values of policies to keep them in force should the premiums become overdue, but I think we may claim it to the credit of our offices that they had all voluntarily adopted this regulation before it became incorporated in any of our legislative enactments.

8. The Queensland Act contains an abominable clause, by virtue of which a life company is compelled to admit the age of the life assured after the policy has been in force for three years without requiring any proof thereof.

9. Under the New Zealand Act holders of policies may, upon payment of a fee of 5*s.*, register the same with the Public Trustee, and the deposits made by the company with the Government will be held as a protection for such policies. I understand, however, that this part of the Act is practically inoperative.

10. One extraordinary provision of the New Zealand Act (contained in section 41 of the Act of 1873) is as follows:—"In "every policy or other contract issued by any foreign company" (and foreign in this Act means not local) "to persons resident "within the colony, it shall be expressly stated that the company "will abide by the decision of the Court." In other words, the right of appeal to a higher Court which is enjoyed by the meanest inhabitant of the colony is denied to a life company. Such a provision is in the highest degree unconstitutional.

11. One excellent provision in these Acts is that by which a company is authorized to pay claims of small amounts (from £100 to £200) without requiring letters of administration.

South Australia is the only colony which has so far imposed a direct tax on life offices. Under the Income Tax Act in that colony a tax of 3*d.* in the £ is levied on the profits allotted to the policyholders resident therein. There is now before the Parliament of New Zealand an Act which proposes to tax life companies to the extent of $\frac{3}{4}$*d.* in the £, either on the assets which the company has in the colony or on the reserve held for the policies, at the discretion of the Commissioner. I do not now express any opinion on the general question of the taxation of life companies, but I may point out that the method proposed in New Zealand is open to the gravest objections. If the tax be levied on the assets, its tendency will be to drive those assets out of the colony; if on the values of the policies, it will be an encouragement to the offices to make the reserves for their liabilities as small as possible. South Australia only asks for a share of the surplus; New Zealand wishes to be inexorable and to levy the tax whether there be surplus or deficiency.

I have reserved for the end of my *resumé* four points which, for their full treatment, would require an entire paper; but they are of so much importance that I should be guilty of a grave omission if I concluded without some reference to them. These are:

(1.) Assignment of life policies.
(2.) Policies effected for the benefit of wives or families.
(3.) Policies in the names of married women.
(4.) Protection of policies in cases of insolvency.

1. You are aware, of course, that a life policy is a "*chose in action*", and is, in consequence, not assignable at law. In equity, however, it can be assigned for valuable consideration, but even in this case, before 1867, in England the assignee could not sue on it in his own name. Under the Policies of Assurance Act of 1867, however, power is given to assignees to sue in their own names. Neither the English Act of 1870, nor any of the American statutes, as far as I am aware, contain any provisions relating to assignments of policies. Provision for such is, however, made by the English Act of 1867, but the execution of assignments in accordance therewith appears to be optional. It is different with the Colonial Acts. I may, in passing, refer to a

great uncertainty in regard to one aspect of assignments in American law. It is contrary to common law, as it is to sound policy, to permit any man to assure the life of another in whom he has no insurable interest; but there appears to be no obstacle to an assignment, after the policy has been issued, by the life assured to an assignee who may not possess such an interest. It has not yet been satisfactorily settled in America whether such an assignment is legal or not. In cases which have been reported, I find that the Courts of New York, Vermont, and Rhode Island, have held such an assignment to be valid, while those of Kentucky, Indiana, Massachusetts, and the United States Supreme Courts, have held the contrary.

Under the Victorian, Tasmanian, and South Australian Acts, a distinction is drawn between assignments which are absolute and those which are conditional or by way of mortgage. The latter (as also assignments by way of trusts), must be made by a distinct deed, but the former, which are the more important, must, in Victoria, and may in Tasmania and South Australia, be made by a memorandum of transfer endorsed on the policy in a form which is given as a schedule to the various Acts. This provision has been and will continue to be productive of grave abuses. The conditional assignment or mortgage, requiring the preparation of a deed, entails expense on the policyholder, the absolute assignment costs nothing, and as the assignment of a policy is usually the result of financial embarrassment on the part of the policyholder, he invariably resorts to the absolute form when he really only intends to execute a mortgage. Under the New Zealand Act of 1884, the question is dealt with in a statesmanlike manner, by means of a memorandum of transfer, as in the other Acts, for an absolute assignment, and a separate form for use when a mortgage only is intended to be executed.

2. The English Act of 1870 contains no reference to policies taken out by married men for the benefit of their wives and families; but provision for such policies is made under the Married Women's Property Act of 1870, the benefits of which have been extended to Scotland by the Married Women's Property Act of 1880. The former was repealed by the Married Women's Property Act of 1882, to which I shall have occasion to refer presently. One English office, the Norwich Union, has devised a special form of policy to meet this case. This form will be found in the Appendix to *Bunyon.*

In the Amended New Zealand Act of 1884 this matter is very

fully dealt with. Provision is there made for the issue of such policies and for the apportionment of the sum assured among the various beneficiaries named in the policy.

The matter is not referred to in any of the other Colonial Acts, but in Victoria provision for the issue of such policies is made in the Married Women's Property Act of 1884, which repealed two previous Acts on the same subject. Under this Act, however, it is necessary for the husband to appoint a trustee in whom the policy will vest, failing which the Court will make the appointment. This course necessarily entails delay and expense, and lacks the simplicity which marks the New Zealand enactment in this regard.

The Married Women's Property Act of 1879 of this colony makes provision for contracts of this character on much the same lines as those of the Victorian Act.

3. The transition from this part of my subject to that of policies in the names of married women is an easy and natural one, and it would appear to have been the aim of legislators to secure the protection of the interests of married women rather by regulating the issue of policies in their own names, than in the names of their husbands for their benefit.

Under the laws of every State in America, a married woman can assure the life of her husband for her separate use, and such policy becomes her sole property and is exempt from the claims of creditors, even though the premiums be paid out of the money of the husband. In some of the States, however, the amount of such premiums is limited to from £30 to £100 a year.

In England, policies in the names of married women can now be effected by virtue of the Married Women's Property Act of 1882, by which, among other things, distinct power is given to a married woman, for, I believe, the first time in the history of British legislation, to effect a policy on her own life for the benefit of her husband. This Act is well deserving of your careful consideration, and to those who wish to know more of the matter, I commend a paper by Mr. Sprague, with a commentary by Mr. Bunyon, (*J.I.A.*, xxiv, 77).

The Married Women's Property Acts of Tasmania, 1883, and of Victoria, 1884, confer similar privileges.

I have not before me a copy of the Married Women's Property Act of South Australia, but it is no doubt of similar import to those I have quoted.

In this colony (New South Wales) power was given to married

women by the Act of Incorporation of the Australian Mutual Provident Society in 1857 to effect a policy in that company in her own name, and this power was extended to apply to policies in any insurance company by the Life Insurance Encouragement Act of 1862. Under these Acts, however, it is only stipulated that such policy shall not be subject to the debts of the husband, and may be disposed of by the member by will. This language appears to me to be exceedingly ambiguous, and I am by no means clear that it gives the woman power to surrender or assign the policy without the consent and concurrence of her husband. The Married Women's Property Act of 1879 removes a good deal of this ambiguity. Under this Act, a policy taken out by a married woman (if it be expressed on the face of it that it is for her separate use) would appear to be disposable by her in any way she may choose.

4. In regard to the fourth point, the protection of policies from the claims of creditors, I fear the atmosphere will be found almost as foggy as that which we have seen surrounding the rights and privileges of married women. I cannot find in the legislation of England or America anything which affords this protection, except in regard to policies taken out by married women or by married men, and expressly stated to be for the benefit of their wives or families. The Colonial Acts have, however, made very full provision for this. With due provision against fraud, the protection afforded by the various Acts is as follows:

New Zealand—To the extent of £2,000 from the inception of the policy.

Victoria—To the extent of £2,000 from the inception of the policy.

Tasmania—To the extent of £1,000 from the inception of the policy.

South Australia—To the extent of £200 after two years, £500 after five years, and £1,000 after seven years.

New South Wales (by the Act of 1862) similar to that of South Australia, with an extension to £2,000 after ten years.

At first sight the provisions for this protection appear very simple and intelligible, but in some cases the application of the principle is involved in grave doubt and uncertainty.

The New Zealand Act of 1884 appears to be very clear on the point; besides setting out in general terms that the policy shall

be protected from the operation of any law relating to bankruptcy, it especially enacts that the policy-money shall not in any way be available for distribution among the bankrupt's creditors, nor become available for the payment of debts under an intestacy. It also enacts that where the life is assured for more than £2,000 (whether under one or more policies, or, as I read it, in one or more offices) only £2,000 of the whole shall be protected. It will be seen directly how important these minute directions are.

The Victorian Act of 1873, too, provides that the protection shall only extend to the sum of £1,000 "in the whole in any policy or policies", and that on the death of the person assured the money "shall not be assets for the payment of his debts."

The Tasmanian Act of 1874 has, however, been unfortunate in this matter. The whole Act is obviously an adaptation of the Victorian Act, but the framers appear to have been too independent to make an exact copy, and have in some places altered the phraseology with disastrous result. In the section relating to protection in insolvency, the Tasmanian Act adds to the words "in the whole in any policy or policies", the words "in any company", and this expression has been held by high legal authority in Tasmania, to mean that the protection is extended to a policy for £1,000 in each of any number of companies; so that a person who is assured in Tasmania in five offices, for £1,000 in each, will be protected to the extent of £5,000, while the unsuspecting policyholder who places his whole £5,000 in one office will only have £1,000 protected. The Act does not, therefore, carry out the obvious intention of its authors; it does not meet the wishes of the offices, and is not guiltless of an encouragement to fraud.

The South Australian Act does not appear to be sufficiently clear on the point. The protection (within the limits I have named) is extended "in respect of any policy on the life of such person", and I am inclined to think that this would be held to bear the same interpretation as that placed on the wording of the Tasmanian Act. But there is another point on which the South Australian Act has proved delusive; the clause bearing on this exempts the policy "from liability to any law now or hereafter in force relating to bankruptcy or insolvency"; but according to the dictum of the Full Court in the case of Goodchild, decided in Adelaide in November of last year, it is likely to be inoperative in many cases. In this case the man's policy was fully protected during his lifetime, and if he had sequestered his estate, the creditors would have had

no claim on the policy. The man, however, died in insolvent circumstances, and under the Public Trustee Act of 1880, the estate went to the public trustee, and the Court held that the proceeds of the policy must be used in payment of the deceased's debts, on the ground that the Public Trustee Act was not a "law relating to bankruptcy or insolvency." The policy, therefore, which was fully protected as long as the life assured was alive, lost that protection immediately he died! Can a more solemn mockery be imagined?

The New South Wales Life Assurance Encouragement Act of 1862 extends the protection to "any policy or contract with any insurance company", and I incline to the belief that this language would be interpreted to mean that the protection applied (within the limits I have named) to each of any number of policies in any number of offices. This was obviously not the intention of the legislature; but I have shown, in several instances, how incompetent legislators appear to be to give expression to their intentions. This Act also protects the policy only from the operation of "any law relating to insolvency or bankruptcy", and it is a question whether, under some circumstances, the aim of the Act might not be defeated as has been the case in South Australia. In the case of A. G. Smyth, decided in our own courts, it was held that the policy was protected for the benefit of the widow, although it had been assigned by the member during his life. If it be possible for our Court to err, it appears to me that it erred grievously in this decision.

As to the general principle, I think there will be no difference of opinion as to the propriety of following the English rather than the American model. We have seen how the latter, notwithstanding its apparently theoretical perfection, has ignominiously failed in practice. And although I confess I have a strong disposition to favour the establishment of some standard of valuation, I am free to admit that I fear it would not be found practicable; and we must remember that we are legislating for men as they are, and not as they ought to be. I am, therefore, driven against my inclination to favour the principle initiated in England and extended in these colonies (especially in South Australia), of compelling the companies to throw open their doors to the scrutiny of the public gaze, and to leave the rest to the criticism of a capable, a fearless, and an honest press.

CORRESPONDENCE.

"ASSET"—"OUTGO".

To the Editor of the Journal of the Institute of Actuaries.

SIR,—Actuaries are in the constant habit of using the word "asset", in such phrases as "a valuable asset", "an unrealizable asset"; and they would find it difficult, if not impossible, to substitute for it any other word that would convey precisely the same idea. Most of your readers will therefore probably be surprized to learn that the word is one not recognized by the dictionaries, which give only the plural form "assets", and either state distinctly, or imply, that the singular form does not exist. Webster's dictionary states that "assets" is derived from French *assez* (enough), and gives the following explanation:—(1) Goods or estate of a deceased person, subject by law to the payment of his debts and legacies; called *assets*, because sufficient to render the executor or administrator liable to the creditors and legatees, so far as such goods or estate may extend. "*Blackstone*" is quoted as an authority for this use. (2) Effects of an insolvent debtor. (3) The entire property of all sorts, belonging to a merchant or to a trading association.—*McCulloch*. Skeat, in his Etymological Dictionary, gives further information as to the word. He says that the final *ts* is a mere orthographical device for representing the old sound of the Old French *z*, as in the word *Fitz* (son), and adds that this *z* was certainly sounded as *ts*, as the German *z* is to this day. He further says, "It will be observed that *assets* was "originally a phrase, then an adverb, then used adjectively, and lastly "employed as a substantive. Of course, it is etymologically in the "*singular*, like *alms*, *riches*, *eaves*, &c.; but it is doubtful if this "etymological fact has ever been recognized."

My attention has been drawn to the point by reading an article in the *American Exchange and Review* for May 1885. This quotes some remarks from the *Baltimore Underwriter*, from which it appears that a New York citizen has been taken to task by one of the newspapers for calling the city sinking fund "an asset". The writer defends the use of the word "asset", but states that it "has been rarely used outside of insurance expression", and implies that it is an insurance technicality. I am, however, under the impression that on this side of the Atlantic it has become well establisht in commercial phraseology, and I am decidedly of opinion that the word is so convenient—in fact, so indispensable—as *singular* "asset", *plural* "assets", that we may well agree to shut our eyes to the irregularity of its formation, and continue to use it without hesitation.

Another insurance word which has not yet found its way into the dictionaries, is "outgo"; used as a brief expression for the total of the payment items entered in the revenue account of a life office, as opposed to "income", which is the total of the receipt items. I find, however, that *Worcester* gives the word, with the explanation, "expenditure, outlay." Some dictionaries give the word "outgoings"

in this sense; but, although this form must be considered as well establisht in general use, most dictionaries do not give it. "Outgo" is not open to any etymological objection, and its general acceptance is probably only a question of time.

I am, Sir,
Your obedient servant,

Edinburgh,
5 *June* 1885.

T. B. SPRAGUE.

MISCELLANEA.

Obituary.—Within the past year, the Institute of Actuaries has lost several most influential and respected members, whose devotion to its permanent interests, and the objects for which it was founded, was constant and conspicuous.

William Barwick Hodge, who died on 17 November 1885, was for many years the secretary and actuary of the General Reversionary and Investment Company. From the earliest days of the Institute's existence, Mr. Hodge took the keenest interest in its progress, and he evinced both his interest in the Institute and his mastery of the science of life contingencies by some instructive papers contributed to Volumes vi, vii, viii, x and xii of this *Journal*. Previous to 1870, Mr. Hodge filled the post of Vice-President of the Institute for several years, and at that date he was elected President, a post which he continued to fill for two years.

Major-General J. C. Hannyngton, who died in March last, was attached to the War Office. He was a Member of the Council of the Institute at the time of his decease. In the pages of this *Journal* contributions have appeared from his pen on the subject of the use of the arithmometer in actuarial and other computations.

Cornelius Walford, who died on 28 September 1885, had, at the time of his death, won for himself a wide renown as a writer on all insurance subjects. The complete list of his works includes the "Insurance Guide and Handbook" and the "Insurance Year Book"—productions of his early life—the "Insurance Cyclopædia", still unfinished (*J.I.A.*, xix, 64), and the "History of Life Assurance in the United Kingdom", to which the Samuel Brown first prize of fifty guineas was awarded in 1884 (*J.I.A.*, xxiv, 145, and xxv, 114), and portions of which have already been given in these pages. Mr. Walford likewise contributed some papers to this *Journal*, and, outside the domain of insurance literature, had produced treatises on "The Ancient Guilds of England", and the "Fairs" of the Kingdom. Mr. Walford was a barrister-at-law of the Middle Temple, a Fellow of the Statistical Society, the Royal Historical Society, and other learned and scientific bodies, in whose transactions he took a great personal interest.

In America, the death of Elizur Wright, on 22 November 1885, has removed a prominent figure from life assurance circles in that country.

It is stated that the introduction of the principle of State supervision into American life assurance legislation was largely due to his action in 1858, when he commenced an agitation having for its object the enactment of a measure framed upon these lines. Mr. Wright was the first Commissioner of Insurance in Massachusetts, and in his early manhood wrote many works upon life assurance of considerable value and merit.

New Publications in 1885.—The following new works of interest to readers of the *Journal* were issued last year:

Notes on Finite Differences. By ARTHUR W. SUNDERLAND, M.A., F.I.A., Assistant-Actuary to the National Life Assurance Society.

Tables for finding the Values of Policies of all Durations, according to any Table of Mortality, or any rate of Interest, with other useful Tables. By JAMES CHISHOLM, F.I.A., F.F.A., Manager and Actuary of the Imperial Life Insurance Company.

The Mortality Experience of the Connecticut Mutual Life Insurance Company, of Hartford, Connecticut, from 1846 *to* 1878. Compiled by D. H. WELLS, Actuary to the Company.

TRANSACTIONS OF THE ACTUARIAL SOCIETY OF EDINBURGH:

No. 11. *On the Official Publications of the Mortality of Assured Lives;* being the Inaugural Address for the Session 1884-5. By JAMES MEIKLE, F.I.A., F.F.A., President of the Society.

No. 12. *Notes on the Theory of Logarithms.* By WILLIAM RAE MACDONALD, F.F.A.

No. 13. *On the several Mortality Tables employed by Life Assurance Companies in the Valuation of their Annuity-Contracts.* By GERALD H. RYAN, F.I.A., F.S.S.

The Law of Fire Insurance (Third Edition). By CHARLES JOHN BUNYON, M.A., F.I.A., of the Inner Temple, Barrister-at-Law.

Vital Statistics: a Memorial Volume of Selections from the Reports and Writings of WILLIAM FARR, M.D., D.C.L., C.B., F.R.S., late Superintendent of the Statistical Department of the Registrar-General's Office, England. Edited for the Sanitary Institute of Great Britain by NOEL A. HUMPHREYS, of the Registrar-General's Office, Member of the Council of the Statistical Society of London.

Insurable Interest and Valuations (Marine Insurance). By RICHARD LOWNDES.

Errata.—On p. 284, in the List of Examiners for the Final Examination, for M. N. Adler, Esq., M.A., *read* W. Hughes, Esq.

On p. 290, in the List of Successful Candidates at the Preliminary Examination, for Walter G. Tregaskis, *read* George Alfred Tregaskis.

JOURNAL

OF THE

INSTITUTE OF ACTUARIES.

On Average Rates of Mortality as affected by the Grouping of the Numbers exposed to Risk at different Ages. By William Thomas Gray, *of the Scottish Equitable Life Assurance Society, Fellow of the Institute of Actuaries.*

[Read before the Institute, 25 January 1886.]

Most persons who have dealt with mortality experiences have, no doubt, observed the variation in the average rates deduced according to the grouping of the exposures, but a few observations thereon, for the benefit of students of life contingencies, may, perhaps, be acceptable.

The first process in the investigation of the rate of mortality among lives assured in an office, or a special class, as annuitants, is to obtain the number exposed to risk of mortality, and the deaths which have actually occurred, at each age, during a certain period of time, as, say, the past five years, or since the company was established. The method to be used for deducing the numbers exposed to risk will depend on the special circumstances of the experience under observation, and need not here be discussed; but, assuming the exposures and deaths to have been ascertained, the mortality experience of the company is deduced by dividing the number of deaths at each age by the corresponding exposures.

A new rate of mortality having thus been obtained from fresh

observations, one is anxious to compare it with those by other tables, deduced from similar or different sources; and for this purpose, as comparisons, age by age, convey but a faint idea of the differences between the tables (especially, if one or more of them be ungraduated); it is usual to obtain the annual rates of mortality for quinquennial, or other groups of ages, from the various tables, as from these average rates the distinctive characteristics (if any) of the tables may be more correctly gauged. The question now arises: Should these average rates for the new table be deduced from the actual exposures and deaths, or from the living in the resulting rough table of mortality? At the outset this would appear to be immaterial, as the same rates of mortality obtain at the individual ages in the group, whether of "exposures" or "living"; but further consideration will show that sometimes marked differences occur in the average rates deduced from these two sources. For illustration, I propose to take the H^M observations of the mortality experience of life assurance companies collected by the Institute, and also the 17 offices experience—from both of which a number of most interesting problems may be selected for investigation.

I.—H^M Experience: Average Rates for Groups of Ages.

The number exposed to risk, and the deaths in these observations, will be found on page 244 of the *Institute Experience*;—the rate of mortality obtained therefrom is given in Col. 1, page 273, where the process of deducing a table of mortality from these probabilities is worked out.

The following Table A shows:

Col. (1). The average rate of mortality obtained by dividing the total deaths, at the five ages specified, by the total exposures according to the H^M observations.

Col. (2). The average rate obtained by dividing the total deaths by the total living, at the same ages, according to the rough tables of mortality.

Col. (3). The average rate deduced as in (3) from the graduated table.

Col. (4). The average rate obtained by taking one-fifth of the sum of the rough rates of mortality at the individual ages.

Col. (5). The difference between Col. (1) and Col. (2).

The rates proposed to be dealt with specially are those in Cols. (1) and (2)—those in Cols. (3) and (4) are only appended for further comparison.

TABLE A.—H^M *Average Rates of Mortality per-cent.*

Ages	From Exposed to Risk (1)	From Living in Table of Mortality: Rough (2)	From Living in Table of Mortality: Graduated (3)	One-fifth of sum of Five Rough Rates (4)	Difference between Col. (1) and Col. (2) (5)
10–14	·383	·391	·358	·391	− ·008
15–19	·469	·389	·410	·391	+ ·080
20–24	·688	·672	·666	·672	+ ·016
25–29	·690	·675	·696	·674	+ ·015
30–34	·821	·819	·810	·819	+ ·002
35–39	·953	·949	·944	·951	+ ·004
40–44	1·067	1·068	1·084	1·069	− ·001
45–49	1·362	1·367	1·368	1·367	− ·005
50–54	1·736	1·741	1·767	1·741	− ·005
55–59	2·399	2·403	2·405	2·408	− ·004
60–64	3·477	3·502	3·467	3·517	− ·025
65–69	5·017	5·067	4·975	5·112	− ·050
70–74	7·329	7·476	7·477	7·640	− ·147
75–79	10·999	11·147	11·314	11·368	− ·148
80–84	16·523	16·736	16·696	17·193	− ·213
85–89	22·346	22·433	22·545	22·537	− ·087
90–94	32·727	33·333	33·308	33·181	− ·606
95–99	54·545	60·000	69·948	64·286	−5·455

In most of the groups the difference is small, but at others the variation is considerable. Comparing Cols. (1) and (2), and excluding for the present the first group (ages 10–14), it will be seen that the exposed rate is largely in excess at ages 15–19, but the difference becomes less almost step by step until at ages 40–44, the "living" rate is the higher, and continues thereafter to exceed the exposed rate more and more, with only two slight variations, as the lives get older. The comparative regularity of the differences is sufficiently remarkable to warrant investigation.

As a first step, it may be well to consider in what way the numbers exposed to risk differ from the living in the Mortality Table. On pages 128 and 129 of the *Institute Experience* a summary of the H^M observations will be found, from which the exposed to risk on page 244 may be obtained. The numbers in the column headed "Lived" are the sum of the "Entered" at that and all previous ages less the total "Died", "Discontinued",

and "Existing" at younger ages, and the "Exposed to risk" at any age is the "Lived" less half the "Entered" and half the "Discontinued" at that age. The "Exposed" may, however, be obtained in another way—which, though not convenient for calculation, shows how the number "exposed" at one age is dependent on the observations at the previous age. Let E_x represent the "exposed to risk" at age x, and n_x, d_x, w_x, e_x, the "new entrants", "deaths", "discontinued", and "existing", respectively. Then we shall have

$$\text{Lived at age } x = \Sigma_0^x(n) - \Sigma_0^{x-1}(d+w+e)$$

$$\text{Lived at age } x+1 = \Sigma_0^{x+1}(n) - \Sigma_0^x(d+w+e)\,.$$

Also,

$$E_x = \Sigma_0^x(n) - \Sigma_0^{x-1}(d+w+e) - \tfrac{1}{2}(n+w)_x$$

$$E_{x+1} = \Sigma_0^{x+1}(n) - \Sigma_0^x(d+w+e) - \tfrac{1}{2}(n+w)_{x+1}$$

$$E_{x+1} - E_x = n_{x+1} - (d+w+e)_x - \tfrac{1}{2}(n+w)_{x+1} + \tfrac{1}{2}(n+w)_x$$

$$E_{x+1} = E_x + \tfrac{1}{2}(n-w)_{x+1} - (d+e)_x + \tfrac{1}{2}(n-w)_x$$

$$= E_x - (d+e)_x + \tfrac{1}{2}\Sigma_x^{x+1}(n-w)\,.$$

That is, the "Exposed to risk" at any age is equal to the "Exposed" at the previous age less the "Died" and "Existing" at that age, plus one-half the sum of the differences between the "New Entrants" and "Discontinued" at both ages. We cannot say from this, or any formula alone, whether the "Exposed" at any age will be greater or less than at the previous age, but on reference to page 244 of the *Institute Experience* it will be seen that the number exposed increases each year from age 0 until 40, at which the maximum is reached, and it then falls—while in the *Mortality Tables,* page 273, the number living is highest at the initial age 10, and decreases throughout life, the number being reduced by the deaths at each age. Another thing to be noted is, that the H^M rough rate of mortality, excluding for the present ages (10–14), increases, with only occasional fluctuations as the lives get older.

Now when the exposures and living between 15 and 39 are summed respectively, for periods of, say five years, each group of exposures contains an increasing proportion of lives at the higher ages—whilst the living taken from the mortality table are most numerous at the youngest age, and decrease as the lives therein get older. The "Exposed" group has therefore a preponderance

of observations when the rate of mortality is high, and the "Living" when the rate is low; hence, between 15 and 39 the average rate obtained from the exposures is greater than from the living. After 40 the exposed and living both decrease as age advances, but the living are only reduced by deaths, while the exposed are decreased by the excess of the Died, Discontinued and Existing over new Entrants; according to the H^M observations, the exposed are reduced, proportionately, more rapidly than the living,* and in the groups from age 40 upwards, the living, as compared with the exposed, have a preponderance of observations at the higher ages, and consequently the average rate deduced from the living is greater than that from the exposed.

In the following Table are given the percentages of the exposed and living at each age in the groups stated:

Ages 20–24			Ages 40–44			Ages 70–74		
Age	Exposed to Risk	Living	Age	Exposed to Risk	Living	Age	Exposed to Risk	Living
20	9·8	20·3	40	20·6	20·4	70	25·6	22·8
21	13·6	20·1	41	20·4	20·2	71	22·6	21·5
22	18·9	20·0	42	20·1	20·0	72	19·9	20·1
23	25·3	19·9	43	19·7	19·8	73	17·2	18·5
24	32·4	19·7	44	19·2	19·6	74	14·7	17·1

To exemplify the effect of the variation of the proportions of exposed and living at the different ages in a group, I propose to investigate more fully the results for groups 15–19, where the maximum excess of the "Exposed" rate occurs; 40–44, where the rates are practically identical; and 75-79, where the excess of the "Living" rate is substantial.

* This will not always be the case; in fact, it is not so at age 41.

Table B_1.

Age	Exposed to Risk (1)	Died (2)	Living (3)	Dying (4)	Proportionate: Exposures Col. (1) $\times \frac{9,806}{908}$ (5)	Proportionate: Deaths Col. (2) $\times \frac{9,806}{908}$ (6)	Differences: Col. 5 −Col. 3 (7)	Differences: Col. 6 −Col.4 (8)
15	908	2	9,806	22	9,806	22	0	0
16	1,129	...	9,784	0	12,193	0	2,409	0
17	1,421	6	9,784	41	15,346	65	5,562	24
18	1,810·5	11	9,743	59	19,553	119	9,810	60
19	2,414	17	9,684	68	26,070	183	16,386	115
	7,682·5	36	48,801	190	82,968	389	34,167	199
	$\frac{36}{7,682·5} = ·00469$		$\frac{190}{48,801} = ·00389$		$\frac{389}{82,968} = ·00469$		$\frac{199}{34,167} = ·00582$	

In Col. (1), we have the exposed to risk against each age in the group 15–19, and in Col. (2), the actual deaths; in Col. (3), the living at those ages in the Mortality Table, and in Col. (4), the corresponding deaths. In Cols. (5) and (6), the numbers in Cols. (1) and (2) are multiplied by $\frac{9806}{908}$ in order to bring up the exposures and deaths at the initial age of the group to the same number as the living and dying in the Mortality Table: this will not, of course, affect the various death rates, and in Cols. (7) and (8) are the differences between (5) and (3), (6) and (4), respectively. It is evident then, that while the average rate among the living is obtained from 190 deaths and 48,801 exposures, the rate from the exposed to risk is obtained from, proportionately, 199 more deaths, against only 34,167 more exposures; and as these latter are subject to a higher rate of mortality than the average of the others, the average rate from the exposed is greater than that deduced from the living.

In Tables B_2 and B_3 similar results are given for groups 40–44 and 75–79 respectively.

TABLE B_2.

Age	Exposed to Risk (1)	Died (2)	Living (3)	Dying (4)	Proportionate: Exposures Col. (1) × 8,223/38,195 (5)	Proportionate: Deaths Col. (2) × 8,223/38,195 (6)	Differences: Col. 5 − Col. 3 (7)	Differences: Col. 6 − Col. 4 (8)
40	38,195	377	8,223	81	8,223	81	0	0
41	37,838	396	8,142	85	8,146	85	+ 4	0
42	37,258·5	399	8,057	87	8,021	86	− 36	−1
43	36,534·5	387	7,970	84	7,866	83	−104	−1
44	35,693	421	7,886	93	7,684	91	−202	−2
	185,519	1,980	40,278	430	39,940	426	−338	−4
	$\frac{1,980}{185,519} = \cdot01067$		$\frac{430}{40,278} = \cdot01068$		$\frac{426}{39,940} = \cdot01067$		$\frac{4}{338} = \cdot01183$	

TABLE B_3.

Age	Exposed to Risk (1)	Died (2)	Living (3)	Dying (4)	Proportionate: Exposures Col. (1) × 2,547/2,693 (5)	Proportionate: Deaths Col. (2) × 2,547/2,693 (6)	Differences: Col. 5 − Col. 3 (7)	Differences: Col. 6 − Col. 4 (8)
75	2,693	254	2,547	241	2,547	241*	0	0
76	2,253	240	2,306	245	2,131	227	− 175	− 18
77	1,848·5	201	2,061	224	1,748	190	− 313	− 34
78	1,531	188	1,837	226	1,448	178	− 389	− 48
79	1,257	171	1,611	219	1,189	161*	− 422	− 58
	9,582·5	1,054	10,362	1,155	9,063	997	−1,299	−158
	$\frac{1,054}{9,582·5} = \cdot10999$		$\frac{1,155}{10,362} = \cdot11147$		$\frac{997}{9,063} = \cdot11000$		$\frac{158}{1,299} = \cdot12163$	

In these groups it will be seen that the average rate from the exposed is obtained from proportionately less deaths and less exposures, but the numbers excluded being subject to a higher

* Strictly speaking, 240 and 162 would be more correct; but, as the Mortality Table gives 241 as the number of deaths at age 75, I have retained that number and adjusted the other deaths accordingly.

rate of mortality than the average of the group, the "Living" rate is higher than the "Exposed".

Referring now to group 10–14, which has hitherto been excluded from consideration, the reason for its not following the general law indicated by the groups for ages under 40 may be at once seen from Table B_4, in which the proportionate exposures for this group have been worked out on a similar basis.

Table B_4.

Age	Exposed to Risk	Died	Living	Dying	Proportionate		Differences	
					Exposures $\text{Col.}(1)\times\frac{10,000}{379}$	Deaths $\text{Col.}(2)\times\frac{10,000}{379}$	Col. 5 −Col. 3	Col. 6 −Col.4
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
10	379	3	10,000	79	10,000	79	0	0
11	434	...	9,921	0	11,451	0	1,530	0
12	491·5	2	9,921	40	12,968	53	3,047	13
13	578	2	9,881	35	15,251	53	5,370	18
14	731	3	9,846	40	19,288	79	9,442	39
	2,613·5	10	49,569	194	68,958	264	19,389	70
	$\frac{10}{2,613·5}=·00383$		$\frac{194}{49,569}=·00391$		$\frac{264}{68,958}=·00383$		$\frac{70}{19,389}=·00361$	

In this group the rate of mortality is abnormally high at the initial age, and is much in excess of the rates at the other ages; the increased exposure group is therefore swelled by a large number of lives, subject to the lower rates of mortality, and consequently the exposures show a less average rate than the living.

The conditions of group 10–14 are exceptional, and, as a general rule, we may say, when the mortality increases fairly well as age advances, that the "Exposed" in groups will give up to the time when the maximum of exposures is reached, a higher average rate of mortality, and thereafter a lower rate than that obtained from the same observations arranged in the form of a mortality table. When there is great irregularity in the mortality, no general rule can be laid down, as a small number of exposures at a high rate of mortality may overbalance a large number subject to a much lower death-rate.

The figures in Tables B are substantially correct, but in all cases allowance must be made for the fact, that a given rate of mortality will not always provide for an exact whole number of deaths out of a specified number of exposures—the fractional difference is, however, immaterial where the exposed are considerable, but in Table B_2, ages 40–44, the differences between the increased exposures and the living are very small, and the expectation of 4 deaths out of 338 exposures brings out an average rate of mortality of ·01183, which is in excess of the highest rate in the group. If the expected deaths had been taken as 3·8, the average rate of ·01124 would be more nearly true, as against ·01068 for the living and ·01067 for the exposed.

The rate given in Col. 4 of Table A, being one-fifth of the sum of the rates for the ages involved, is not, I believe, often used in practice. It has the disadvantage of giving as much weight to the smallest number of exposures in a group, as to the largest, and when, as is often the case in small societies, and at the extremities of a large experience, the observations are few; this method gives occasionally peculiar results, as may be seen from the following table:

TABLE C.

Exposed	Died	Rate per-cent	Died	Rate per-cent	Died	Rate per-cent
3	...	·000	3	100·000	...	·000
9	3	33·333	...	·000	3	33·333
9	2	22·222	2	22·222	...	·000
10	4	40·000	...	·000	2	20·000
8	...	·000	4	50·000	4	50·000
39	9	95·555	9	172·222	9	103·333
$\frac{9}{39}=23{\cdot}077$ per-cent		$\frac{1}{5}=19{\cdot}111$		$\frac{1}{5}=34{\cdot}444$		$\frac{1}{5}=20{\cdot}667$

Here, out of 39 exposures 9 have died—according as the deaths are assumed to have taken place at different ages in the group, so different average ($\frac{1}{5}$) rates are obtained. This method, in fact, does not sufficiently allow for unfavourable results at one age, where the numbers are small, being counterbalanced by favourable rates at others, where the exposures have been more numerous; but for those parts of the experiences at which the exposures and deaths are well distributed, it gives good results, as may be seen by comparing in Table A, Col. (4) with Col. (2), for

ages 10–69. It has, also, the decided advantage of not necessitating the formation of a mortality table, nor the summation of exposures, living, and deaths.

In Table D are given the differences between the average rates deduced from the exposed and the living, in the rough and graduated H^M Tables, with the sum of the respective differences, from the youngest age upwards.

Table D.—*Comparative Differences in* H^M *Average Rates of Mortality per-cent.*

Ages	Exposed less Living Rough Table		Exposed less Living Graduated Table		Living in Rough Table less Graduated	
	Δ (1)	ΣΔ (2)	Δ (3)	ΣΔ (4)	Δ (5)	ΣΔ (6) =(4)−(2)
10–14	− ·008	− ·008	+ ·025	+ ·025	+ ·033	+ ·033
15–19	+ ·080	+ ·072	+ ·059	+ ·084	− ·021	+ ·012
20–24	+ ·016	+ ·088	+ ·022	+ ·106	+ ·006	+ ·018
25–29	+ ·015	+ ·103	− ·006	+ ·100	− ·021	− ·003
30–34	+ ·002	+ ·105	+ ·011	+ ·111	+ ·009	+ ·006
35–39	+ ·004	+ ·109	+ ·009	+ ·120	+ ·005	+ ·011
40–44	− ·001	+ ·108	− ·017	+ ·103	− ·016	− ·005
45–49	− ·005	+ ·103	− ·006	+ ·097	− ·001	− ·006
50–54	− ·005	+ ·098	− ·031	+ ·066	− ·026	− ·032
55–59	− ·004	+ ·094	− ·006	+ ·060	− ·002	− ·034
60–64	− ·025	+ ·069	+ ·010	+ ·070	+ ·035	+ ·001
65–69	− ·050	+ ·019	+ ·042	+ ·112	+ ·092	+ ·093
70–74	− ·147	− ·128	− ·148	− ·036	− ·001	+ ·092
75–79	− ·148	− ·276	− ·315	− ·351	− ·167	− ·075
80–84	− ·213	− .489	− ·173	− ·524	+ ·040	− ·035
85–89	− ·087	− ·576	− ·199	− ·723	− ·112	− ·147
90–94	− ·606	−1·182	− ·581	− 1·304	+ ·025	− ·122
95–99	−5·455	−6·637	−15·403	−16·707	− 9·948	−10·070
	+ ·117 −6·754		+ ·178 −16·885		+ ·245 −10·315	
	−6·637		−16·707		−10·070	

Let us now assume that a company has experienced the same rate of mortality at each age as that indicated by the rough H^M mortality table, and that its exposures and deaths being in the same proportion as the H^M observations, the company finds its average rates of mortality [given in Table A, Col. (1)], to coincide with those obtained from the H^M exposures and deaths. If now it compares these rates with the H^M graduated rates [given in Table A, Col. (3)], it will apparently, at all ages under 70,

Table D, Cols. (3) and (4), have experienced an excess of mortality over that provided for by the H^M graduated tables, the falling off at some ages being more than counterbalanced by the excess at others, but over 70 its rates will appear below the expectation. A consideration of Cols. (1) and (2), Table D, will, however, show that the apparent differences are really in the main the result of the altered form in which the numbers at risk are arranged in office practice and in the table of mortality resulting from identically the same death-rates. Further, Cols. (5) and (6) of Table D show the very slight transfers of mortality from group to group which have been made by the process of graduation employed on the H^M Table; and it will be well to remember, when comparing the average rates from exposures with the rates from the resulting graduated table, that the whole of the difference is not due to the process of adjustment.

II.—17 Offices Experience.

This table having now been discarded for assurance purposes, no benefit would result from the publication of the results of an investigation into the variation between its "Exposed" and rough "Living" rates of mortality as set out in Table A for the H^M Experience, but the figures are at the service of anyone who might wish to examine them. The general effect of the investigation is, however, to confirm the views previously expressed as to the "Exposed" rate being in excess until the maximum of exposures is reached, after which the living rate is the higher. The irregularity in the rough rate of mortality from age to age which characterized the 17 offices experience, is accountable for the fluctuation in the differences between the two rates ("Exposed" and "Living"), which this investigation discloses. The same cause also accounts (as for group ages 10–14 in the H^M Experience) for the "Exposed" rate in three out of the first six groups being below the "Living" rate; after the maximum of exposures is reached, however, the "Living" rate is, with the exception of the final group (ages 95–99), always in excess of the "Exposed" rate.

It is apparent, therefore, that to test closely one experience with another, the rates from exposures in the one should be compared with that from the exposures of the other; or more generally, as the exposures in most tables are not always at hand, the rates from the living in the one should be weighed with the

corresponding rate in the other table—the rough with the rough, and the graduated with the graduated. When, however, the graduated testing table follows closely to the original facts, the comparison of the rough "Living" rates of the new table with the graduated "Living" rates of the testing table may be made with small risk of error, but if the latter be measured with the "Exposure" rates of the new table, the impressions conveyed will sometimes be misleading.

In practice it is frequently necessary, in the valuation of burial, annuity, and other societies, to find a table with which the past mortality of the lives involved approximately corresponds; and as the average rate, for groups of ages, of most tables is given, the preceding observations may be of some slight assistance to valuers. When comparing the average "Exposed" rate of the past experience of the society under valuation with a table proposed to be used, it must be remembered that the table of mortality should show a somewhat lower death-rate than that of the society's actual experience up to the group at which the maximum of exposures has occurred, and thereafter a heavier rate. Having selected a table answering as nearly as possible these requirements, the expected deaths amongst the exposed to risk may then be calculated by the selected table for further confirmation of its applicability.

Discussion.

The Chairman (Mr. M. N. Adler), in inviting discussion, said that Mr. Gray's paper proved that precautions had to be taken in comparing the mortality of an office with that of a standard table. One of the ordinary duties of the actuary was to satisfy himself periodically, as to the extent to which the actual mortality experienced by his company fell short or exceeded the expected mortality; but he thought there was a want of uniformity in the mode of computing the expected mortality. Mr. G. M. Low's paper on the subject (*J.I.A.*, xviii, 195) was a very interesting one, but it failed to call attention (as Mr. Gray's paper had done) to the risk of falling into error, unless tables which are in every respect homogeneous are compared. Since the H^M Tables had been published, there had been fewer instances of the experience of the various offices being made known than was the case before the publication of those tables; but, seeing that each office has a mortality experience of its own (which, to judge from their reports, is periodically investigated), it would be very useful if their experience were deduced systematically and correctly, with a view to their eventual publication. He did not know why, in the returns to the Board of Trade, there

should not be a question put, similar to the question put to the friendly societies by the central registry office, asking whether any investigation into the mortality had been made, and what were the results.

Mr. G. King remarked that the paper opened up questions of principle which deserved further discussion. He did not know in what way Mr. Gray meant his test to be applied. His (the speaker's) idea would be, not to compare the rates of mortality, either at single ages or by groups of ages, with the rates of the testing table, but to take out the expected deaths and compare them with the actual deaths. In no other way could a clear idea of the differences in rates of mortality be obtained. If the expected deaths by the testing tables for each year of age were compared with the actual deaths, they would get a decidedly better idea how the mortality fell, than by taking out the rates of mortality in any of the three ways discussed by Mr. Gray. For some purposes it was very useful to have their attention drawn to these three methods of getting out the comparative rates of mortality. If they wanted to compare two tables already formed, there was no real means of getting out the expected deaths, and they must take up one or other of these methods. Taking Mr. Gray's first Table, A (p. 371), it would have been an advantage if he had added after column 5, a further column giving the percentages of error between the rates obtained from "exposed to risk" and from "living in table of mortality." These percentages throughout were very small. There was only one age at which the percentage, as distinct from the actual figures, came out large, and that was the group of 15 to 19, where the "exposed to risk" were very small. Towards the end of the table, the percentages were always about 2 per-cent, until at the very last ages 95 to 99, at which period no one would treat experience as of the slightest importance. The chief feature of interest in Table A was not the actual differences in the figures, but the algebraical signs of those differences. It was interesting to see the positive signs at the beginning, and the sign from age 40 downwards without intermission negative. But the point Mr. Gray raised in connection with experience tables must be carried a great deal further. Investigations of the experience of individual offices have not been so common since the Institute Tables were brought out. That might be explained by the offices being content with the Institute Table; but it might also be explained by reason of there having been a good many investigations into the incidence of mortality with the general conclusion that average tables, such as those of the Institute, were not so valuable as used to be thought. Where new entrants came in in great numbers, the rates of mortality were so much disturbed that no reliance could be placed upon them. The question of the "discontinued" also arose, but that was not of so much importance. The new entrants, coming in from 20 to 50 in large numbers, reduced unduly the rates of mortality by the average table during the first half of life, and, as they knew, for premium purposes the H^M Table was too low for the earlier ages, and too high for the later from that very cause. It was quite true that for purposes of valuations where lives of all descriptions were included, the H^M Table gave useful results; but when dealing with single ages or small groups of ages, as Mr. Gray had done, the H^M Table was altogether misleading, and all tables that are based upon observa-

tions of the same kind must, not accidentally but from the very fundamental principles underlying them, be misleading. Therefore, although it was sometimes useful to compare one experience table with another where the entrants came in much the same proportions, yet in dealing with the individual experiences of offices, and comparing expected with actual deaths, he doubted if there was very much good to be gained by it. Mr. Gray said it was not usual in practice to take the mean of the several rates of mortality in order to get the average rate. In constructing the English Table, Dr. Farr, however, followed this course for the ages up to 5. Towards the end of the paper Mr. Gray seemed to fall foul of such mathematicians as Mr. Woolhouse on the subject of graduation. Mr. Woolhouse maintained (and he thought justly), that where they had a well-graduated table, the mortality represented by the graduated table was more likely to be repeated in the future than the mortality represented by the ungraduated table, and therefore if the graduation had been fair and proper they ought to discard altogether the ungraduated result. If they did not, it would seem that there was a suspicion that the graduation had not been a proper one. He could not altogether echo the hope that the Chairman expressed with regard to including particulars of mortality experience in the Board of Trade Returns. He did not think they would be of much use; and further, as the mortality of the life office was practically beyond the control of the actuary, he did not think that he should be held responsible for it. If such experience were given at all, it should be given for each age of entry, because for a few years the directors had a certain control over the rate of mortality. But if the average rates of mortality were compared with those taken from the Institute Tables, he did not think the results would be of any good.

Mr. G. S. Crisford said he thought there was a tendency to accept a table which was generally admitted to be a standard table, and to be content with results which it might give without that individual testing which Mr. Gray had recommended. In taking the experience of an office as to the deaths in any one year or at any time, if the mortality was to be tested, it would hardly do to depend upon the mere grouping of ages, on account of the various exceptional cases which might entirely upset anything like an average result at any particular age. The only fair or reasonable comparison would be the result of the whole of the mortality. In some of the particulars which were taken out, the difference between the "exposed to risk" and the number living in the graduated table might be occasioned by the manner in which the table was formed. The number of entrants would be greater sometimes in the beginning or the end of the year, and this would upset the average. Seeing that there were these inequalities, he was not sure that it would do to depend for comparisons of the mortality upon the rough figures, as was suggested by Mr. Gray, when he said that the right plan would be to compare the rough with the rough and the graduated with the graduated. Taking both tables of rough results would give rise to great danger of inaccuracy. This would be less likely to occur, as Mr. King had pointed out, if the tables were properly graduated.

Mr. G. H. Ryan thought that while there was little scope for comment, either by way of criticism or illustration, upon the main point of Mr. Gray's paper, there were nevertheless several matters lightly touched upon which the members would be glad to discuss. In dealing in the first instance, with Table A, Mr. Gray had compared the rate of mortality obtained from the "exposed to risk" with the rate of mortality obtained from the rough living column in the mortality table. Although in point of theory that might be the correct mode of procedure, it was open to certain objections. In the first place, in assuming as inferred in the concluding paragraph of the paper that the object of the investigation was to select a table for the purpose of valuation, as all tables of monetary results were superimposed, not upon the ungraduated or rough table, but upon the graduated results, it seemed essential that in such a comparison they should employ the graduated figures. Whether the actual process adopted by Mr. Gray was ever employed in practice, he was unable to say, but it had not come under his personal observation. He believed that the way in which the comparison was generally made was to take the graduated rate of mortality at the mean age, and multiply that into the grouped "exposed to risk". Where they could not consistently look for minute accuracy, this process would give results abundantly near the truth. In cases where a closer approximation was needed they should still employ the graduated table, not, however, taking out the function at the mean age, but at an age obtained by giving due weight to the observations at the several ages respectively. Passing to Table D, there was a point which Mr. King had raised that might be referred to again. In order to give the cumulative difference between the three sets of results, Mr. Gray had there taken the differences between the rates of mortality and summed them. That involved an error which, in regard to other points, Mr. Gray had kept clear of, namely, that of neglecting to give proper weight to the incidence of the facts at individual ages. It would be better to take out the probable deaths, to compare them with the actual deaths in each group, and to sum continuously the differences. By that means they would be able to ascertain, with greater trustworthiness, the cumulative difference between the tables. A reference made by Mr. Gray to the formulas for deducing the "exposed to risk", opened up a question of wide range which, he thought, had hardly been discussed at sufficient length in the Institute. Mr. Gray gave some formulas showing the modes in which the "exposed to risk" could be obtained, and some of his expressions lent themselves to manipulation with instructive results. In reference to the general question of the "exposed to risk", the complexity and the confusion which surrounded it were caused, not so much by the nature of the subject itself, as by the methods which had been adopted from time to time, in order to arrive at the function and to compute the principal tables of experience. In the Institute Experience, for example, they followed the observations through calendar years; and by that means they were involved in the difficulty of having only a half-year as the nominal first year of insurance. They also had to deal with a fractional age at the commencement of the first calendar year after entry, and a fractional age at the termination of the observations. If the plan were adopted of

following the observations through policy years, much of the confusion which now invested the subject of "exposed to risk" would disappear, and all the minute investigations that had taken place into the true rate of mortality in the first full year of insurance would not be needed, because the first year of insurance would then be a complete year. Also the formula for the exposed to risk would be much simplified, and they would get rid of some of the rather formidable expressions which Mr. Gray had given. It was worthy of remark with regard to one of these expressions,* that a trifling alteration reproduced the formula according to which Mr. Meikle had computed the Scotch tables of experience—a formula far more easy of application, and affording greater facilities for verification, than the, comparatively speaking, cumbrous method which the Institute authorities adopted. If the convenient system of policy years, laid down more than forty years ago by Mr. Thomas Galloway, were employed, the expressions would lose much of the complication which was unavoidable when they adopted calendar years in accordance with the Institute and the Scotch plan. Some American authorities lately decided on the superior merits of the plan of policy years, as against calendar years, and in dealing with the individual experience of a life assurance company that method was, he thought, far superior to the one adopted in the case of the Institute observations. No doubt, in the latter system, some countervailing advantages presented themselves, which led the authorities to make use of the process actually employed, but many people, seeing that a certain method had been sanctioned and employed by the Institute, would imagine that that method was the best and most desirable under all circumstances; and this, for reasons already given, he did not think was the case. In the last paragraph but one of Mr. Gray's paper, he appeared to assume that an extreme degree of accuracy was required in the comparison of the respective tables, because he had suggested that in order to measure the experience of a company with the testing tables, they should, before making any approximate comparisons, compute a mortality table from the rough results, and measure the respective rates of mortality one with the other. He (Mr. Ryan) did not think that that was followed in practice, or was necessary. If, indeed, they multiplied the grouped exposed to risk by the graduated rate at the mean age, when the result was comparatively unimportant, or at the age obtained by giving due weight to the incidence of the facts, in cases where greater accuracy was required, abundantly accurate results would be obtained.

Mr. H. W. Manly said that the summary of the paper seemed to be that if it was wished to ascertain what table of mortality or what monetary tables to use in the valuation of any society, the actuary would not be very far wrong if he took out, for purposes of

* The expression here referred to is

$$\Sigma_0^x(n) - \Sigma_0^{x-1}(d+w+e) - \tfrac{1}{2}(n+w)_x$$

(p. 372), which, by an obvious transposition, becomes

$$\Sigma_0^{x-1}(n) - \Sigma_0^{x-1}(d+w+e) + \tfrac{1}{2}(n-w)_x.$$

This is identical with the formula by which Mr. Meikle computed the exposed to risk from the Scotch observations (see *J.I.A.*, xiii, 267).

comparison, the rough mortality in groups of quinquennial ages. The differences presented between the actual details of the experience and the graduated results were so small that he did not suppose any one would attach much weight to them. A perusal of this paper led to a consideration of the various methods employed to ascertain the expected deaths in different offices. It would be exceedingly interesting if they could discover the nature of the different processes employed. The Chairman had proposed that the offices should be asked to make a return to the Board of Trade of their mortality experience; but that would impose a gigantic task upon them. In the reports of most offices, certain figures were presented to the public showing, usually, that the expected claims were much larger than the actual experience. He had often thought it would be very interesting to know how those figures were arrived at. It was certainly extraordinary that they seldom saw figures on the other side of the account; and it was a fact that a majority of offices always presented this remarkable result. He once discovered that the expected deaths in a certain society had been calculated by multiplying the number of members on the books by ·021, the reason given for this course being that the rate of mortality among the general population of the country was stated in the Registrar-General's returns to be 21 per 1,000. He did not know whether that had ever been done before or since, but related it as a fact. As something more modest than the Chairman's proposal, he would suggest that if they wanted any addition in the returns made to the Board of Trade, instead of the rate of mortality they might ask if the expected mortality was ascertained, and how it was ascertained. That information would be interesting, and would not entail any great additional labour. The questions involved in the general subject of mortality experience to which Mr. Ryan had referred would afford a very instructive evening's discussion; but he (Mr. Manly) was not prepared to agree that the method of constructing tables adopted by Mr. Galloway was the right one. It was possible at some, not far future day, they might have to collect the further experience of the offices; and it would be wise, therefore, to discuss beforehand how the facts should be collected and worked up.

The Chairman having proposed a vote of thanks to the author,

Mr. W. T. Gray said that reference had been made to the different ways of taking out the "exposed to risk"; but that was a subject which he had not ventured to attack in this paper. He had found, in the course of his experience, that different valuers often followed quite different plans, and they thus got very different results. A year or two ago he ascertained that it was the practice in some companies, in getting out their expected deaths, to multiply the "exposed to risk" amongst those who had been assured for less than five years by the H^M rate of mortality, and amongst those who had been assured longer than five years by the $H^{M(5)}$ rate. If this method was really followed, it would account for one hearing so often that the actual deaths had been below the expectation by the H^M Tables. He thought the individual experiences of different offices had a great deal more value than some people appeared to attach to them. He believed the experience in each office was different from that of its competitors, and that some actuaries did not follow up that possible

difference, and the consequent variation in the reserves, as far as they might. With regard to the quinquennial returns which some of the members feared they might be called upon to make, he thought a great deal of the work was already done. It was only a question of publishing what had been prepared. Mr. King and Mr. Ryan had both referred to the same point: having got the "exposed to risk", they said that they should prefer, instead of comparing the rates, to multiply the "exposed to risk" by the rates of mortality in the table they were going to use. The point upon which this paper was written was to suggest how to select the table for use. As regards insurance companies, nearly everybody valued by the H^M Table whether it was applicable to them or not; but in the case of a small friendly society it was often difficult to know what table to use. They might have to examine the Manchester Unity ordinary table, or the Colliers' and Miners' table, or some of Mr. Neison's or Mr. Ansell's tables, in order to find one which really met the case. On one occasion in his recollection, it was found necessary to calculate a table specially for a particular society. For one set of ages they used the Northampton, and for the remainder of life the Government Female Annuitants' Table; and the resulting table represented the actual mortality of that particular society over a very long period. In writing his paper, he had desired to show how identically the same death-rates varied if obtained from the "exposed to risk", or of the "living" in a table of groupings of mortality. Now, if two rates deduced from the same source varied so much, it followed that in taking the "exposed to risk" of a particular society, and in looking about for a table to suit it, they would be comparing two rates which might be very different; but as they wanted to get those two rates as nearly equal as possible, he had suggested that in order to find a suitable table some little manipulation was necessary. They would have to look out for a table where the rate was higher than the "exposed to risk" rate of mortality for the one part of the experience and lower for the remainder. It had been questioned whether the rate that he had given in Col. 4 of Table A—one-fifth of the sum of five rough rates—was much used in practice. A very large society in London some years ago took out its mortality experience, and he remembered well that they did use this one-fifth rate. It had rather a peculiar result, because it so happened that there was a member who died in the first six months after entry, and in consequence of this being the only exposure at his age, the rate of mortality came out at 200 per-cent, and whenever this particular case came into a group it threw out the experience altogether. The method was useful sometimes, and, where the figures were large, the results were so far very satisfactory. He did not suggest that if an office were to take out its experience, it ought to compare it with the valuation table exactly as he had done and rest satisfied because the rates pretty nearly agreed; but, having found that they did agree, the expected deaths amongst the "exposed to risk" might then be calculated by the selected table. As regards the graduation which Mr. King referred to, the result of Table C was, he thought, to show that the graduation of the H^M Table had been highly successful; it kept the mortality exactly where the rough results placed it; and that being so, the art of graduating a table had there

been very successfully carried out by Mr. Woolhouse. Whether his particular method would always apply was another thing. He did not suggest that anybody should make a valuation by rough tables; he had said nothing at all about valuations; but he merely compared rough tables of mortality of one sort with another. At some future day, if he had anything to say about valuations, he should be careful not to suggest that they should be based upon rough tables of mortality.

Office Premium Loadings, and how they are dealt with in Valuation and Distribution of Profits. Part II. By George Stephen Crisford, *Actuary of the Rock Life Assurance Company, and Fellow of the Institute of Actuaries.*

[Read before the Institute, 22 Feb. 1886.]

THE first part of this paper was devoted to an investigation of the actual rates charged by the different companies, with a view of showing how important a bearing they have upon a valuation. Before commencing the second part of my subject, which deals with different modes of distributing profits when placed side by side with the rates charged, I would recapitulate the conclusions drawn from the first part of my paper, and, in addition, refer to some of the observations which were made thereon when the paper was read before the Institute last session.

The conclusions which I arrived at after my investigation may be summed up as follows:

1. The actual rates charged by a company should always be taken into consideration before determining the principle to be adopted in a valuation.
2. Under a net premium valuation it is quite possible that an insufficient reserve may be made for future expenses and profits when the premiums, either on the whole or at special ages, are low.
3. The security of a company, and the margin of profit reserve, can only be ascertained by a careful examination of the actual premiums charged at different ages when placed side by side with the method adopted in the valuation, and, generally, the basis adopted in the valuation of the liabilities of a life office is not an unfailing test of its stability, or a sufficient indication of its future prospects.

I wish to emphasize this general conclusion, because, as already stated in Part I, it frequently appears in the public press that the basis of valuation being a popular one, this, alone, is taken as sufficient guarantee that everything else must be satisfactory—indeed, it is not unfrequently urged, that offices should be compelled to adopt one uniform standard of valuation, both as to rate of interest and table of mortality. Whereas, a little deeper examination will show such a regulation would not be the best test, for, until every office charges the same rate, and adopts the same method of distribution of its profits, there can be no hard-and-fast line adopted which would be an equitable one for all. The question also of a net-premium or a gross-premium valuation, and the results brought out in the way of reserves for future profit, can only be properly gauged after the actual premiums charged have been compared with the net premiums assumed.

Now, as to some observations made upon my last paper.

Reference was made to the reinsurance method of valuation, and I was asked why I had passed over this method. My answer is a simple one, and can best be put in words, by quoting from a paper in the *Journal* (vol. xi, p. 90), by Mr. Sprague.

The reinsurance, or, as Mr. Sprague calls it, the hypothetical method, is very fully discussed in that paper, together with reference to the opinions of Mr. Jellicoe and Mr. Tucker.

It is there shown that the value by the reinsurance method may be less than, equal to, or greater than, the value by the net-premium method, or, *i.e.*—

"When the difference between the net premium and that "charged is a constant quantity, or decreases as the age increases, "then the value of the policy, as formed by the reinsurance method, "will be *less* than the value found by the net-premium method—"on the other hand, when the loading is a constant percentage of "the net premium, the values, as given by the reinsurance "method, are greater."

This, Mr. Sprague proved by a neat mathematical demonstration.

The above being demonstrated, it at once becomes clear that no accurate comparison under the reinsurance method can be made until the loading is first determined, and as the loading may vary at every age, the exact effect of a valuation under the reinsurance method will be equally variable. This only the more forcibly illustrates the important bearing which the actual loadings contained in the premiums charged at the various ages must have upon a valuation, both under that method as well as under the gross and net-premium method.

I should like to remark, that were it not for the uncertainty of value brought out, I should endorse the reinsurance method as sound in principle and proper in practice, and it brings to bear the very arguments which I have been advocating, namely, the dealing with the actual premiums charged. The weak point of the reinsurance method is, that before it can be adopted with satisfactory results, the effect of the loading should be fully determined, and in practice this is very seldom the case.

The following tables (pp. 390, 391) may be interesting as indicating how this method of valuation compares, in a few cases, with H^M 3 per-cent net.

My attention was also called to the fact, that the H^M pure premiums do not properly represent the risk premium, and that Mr. Sprague's Select Life Tables would show that the risk premium is higher at the younger ages and lower at the older ages than that brought out by the H^M Tables. Upon that observation I would merely say, that when the H^M Tables, pure and simple, are adopted, it is the H^M premium which is, at all events, assumed in the valuation as the proper risk premium. When I speak of pure premium, or margin for profit, I use these terms only in a qualified sense, so far as they are shown by a comparison of the rates charged, and the basis actually adopted; and in this paper I wish to avoid, in any way, dealing with a theoretical investigation of what rate is, or is not, the proper risk premium, but in order to show that the adoption of the Selected Life Tables would make no difference to the variableness of the loading, the following are illustrations of the loadings under these tables:

Mr. Sprague's Select Life Tables—4 per-cent Net-premium.—Profit Margins shown under the Rates charged by Eight Different Companies.

15	20	25	30	35	40	45	50	55	60
·232	·228	·343	·415	·485	·536	·573	·588	·553	·471
·395	·429	·525	·570	·600	·615	·600	·568	·443	·258
	−·251	−·239	−·226	−·239	−·257	−·315	−·378	−·507	−·701
·303	·326	·415	·447	·462	·457	·418	·418	·396	·258
·185	·140	·201	·210	·188	·148	·081	·027	−·017	−·007
·113 }	·112	·260	·371	·449	·548	·588	·735	1·087	1·567
−·041 }	−·061	·058	·142	·168	·191	·149	·157	·308	·499
	−·121	−·002	·031	−·010	·001	·081	·157	·237	·384
	·053	·046	·007	−·017	−·010	·023	·137	·233	·222

Table of Policy-Values £100 by Six Offices adopting the Reassurance Method compared with H^M *3 per-cent Net Values.*

Age at Entrance	15	20	25	30	35	40	45	50	55
H^M 3 per-cent . .	4·618	4·360	5·311	6·135	7·203	8·708	10·228	12·100	14·189
	4·756	4·165	4·568	5·323	6·251	7·139	9·220	10·873	11·824
	4·280	4·795	5·151	5·654	6·463	7·938	9·516	10·380	11·704
$_5V_x$	3·598	4·155	5·041	5·738	6·517	8·682	9·769	11·392	13·859
	3·763	4·493	5·206	5·384	6·690	6·999	9·298	13·383	14·262
	4·299	4·750	5·451	6·278	7·057	8·187	9·221	10·550	12·204
	4·277	5·256	5·918	5·972	7·605	7·765	10·285	13·663	15·620
H^M 3 per-cent . .	8·776	9·440	11·121	12·897	15·284	18·045	21·091	24·573	...
	8·742	8·550	9·666	11·264	12·929	15·737	19·179	21·439	...
	8·884	9·704	10·516	11·750	13·913	16·715	18·917	20·844	...
$_{10}V_x$	7·569	8·969	10·462	11·890	14·646	17·624	20·034	23·657	...
	8·100	9·484	10·332	11·703	13·197	15·669	20·514	24·889	...
	8·830	9·971	11·396	12·890	14·692	16·652	18·780	21·451	...
	9·320	10·851	11·527	13·136	14·781	17·278	22·558	27·131	...
H^M 3 per-cent . .	13·622	14·996	17·523	20·481	23·948	27·962	32·287	...	...
	12·551	13·435	15·334	17·586	20·992	24·888	28·673	...	...
	13·583	14·811	16·297	18·779	22·120	25·368	20·384	...	...
$_{15}V_x$	12·212	14·179	16·314	19·551	23·004	26·995	31·102	...	...
	12·902	14·378	16·320	17·860	21·288	26·097	31·860	...	...
	13·827	15·632	17·647	20·046	22·557	25·429	28·679	...	...
	14·675	16·166	18·268	19·883	23·570	28·595	34·639	...	...
H^M 3 per-cent . .	18·921	21·119	24·705	28·614	33·151	38·183	...	...	...
	17·569	18·867	21·366	25·218	29·573	33·793	...	...	...
	18·471	20·315	22·964	26·522	30·211	34·081	...	...	...
$_{20}V_x$	17·233	19·777	23·592	27·429	31·763	37·100	...	...	...
	17·612	20·096	22·155	25·517	31·020	36·646	...	...	...
	19·245	21·585	24·412	27·418	30·713	34·517	...	...	...
	19·762	22·554	24·617	28·144	34·027	39·734	...	...	...

H^M 3 per-cent . .	24·761	27·987	32·406	37·252	42·636	...	...	...	...
	22·742	24·648	28·648	33·340	37·923	...	...	...	...
	23·738	26·662	30·309	34·156	38·359	...	...	...	...
	22·635	26·753	31·074	35·685	41·208	...	...	...	...
$_5V_x$	23·114	25·668	29·412	34·727	40·868	...	...	...	...
	24·943	28·026	31·382	35·061	39·156	...	...	...	...
	25·876	28·569	32·391	37·977	44·319	...	...	...	...
H^M 3 per-cent . .	31·313	35·353	40·585	46·156	...	...	...	...	...
	28·247	31·625	36·397	41·243	...	...	...	...	...
	29·812	33·654	37·539	41·843	...	...	...	...	...
	29·352	33·925	38·915	44·587	...	...	...	...	...
$_{30}V_x$	28·475	32·597	38·141	44·044	...	...	...	...	...
	31·109	34·662	38·607	42·975	...	...	...	...	...
	31·633	35·936	41·641	47·652	...	...	...	...	...
H^M 3 per-cent . .	38·338	43·175	49·016	...	...	...	...	...	...
	34·890	39·051	43·937	...	...	...	...	...	...
	36·504	40·547	44·840	...	...	...	...	...	...
	36·279	41·442	47·370	...	...	...	...	...	...
$_{35}V_x$	35·143	40·933	46·970	...	...	...	...	...	...
	37·460	41·542	46·089	...	...	...	...	...	...
	38·684	44·701	50·745	...	...	...	...	...	...
H^M 3 per-cent . .	45·800	51·238	...	...	...	...	...	...	...
	41·962	46·277	...	...	...	...	...	...	...
	43·100	47·488	...	...	...	...	...	...	...
	43·528	49·547	...	...	...	...	...	...	...
$_{40}V_x$	43·163	49·363	...	...	...	...	...	...	...
	44·046	48·666	...	...	...	...	...	...	...
	47·073	53·328	...	...	...	...	...	...	...
H^M 3 per-cent . .	53·490	...	...	...	...	...	...	...	...
	48·842	...	...	...	...	...	...	...	...
	49·744	...	...	...	...	...	...	...	...
	51·344	...	...	...	...	...	...	...	...
$_{45}V_x$	51·276	...	...	...	...	...	...	...	...
	50·865	...	...	...	...	...	...	...	...
	55·330	...	...	...	...	...	...	...	...

The only other observation I wish to refer to is, "it was "urged that, in my last paper I brought together all the lowest "premiums charged at different ages on the one side, and all the "highest on the other, thereby rendering the conclusions simply "theoretical, and not practical."

I pointed out that both the low rates and the high rates were those actually in use at the present time, and that I had brought the extremes together the more forcibly to show the results; but it must surely be admitted, that, although, when grouped together a general average may be formed, the valuation of the individual policies remains unaltered, and the tendency may not unnaturally be, that offices charging a low premium at particular ages would be more likely to attract the larger number of intending policy-holders at those ages. The more this is the case, the more forcibly would my conclusions be brought to bear.

Now, as to the dealing with loadings under different methods of distribution. It may be very rightly argued, that the loading alone is but one element of profit, and that whenever the true rate of interest is not assumed, the question of interest profit becomes a very important one. This is a subject I should like to see some members of the Institute take up for investigation. It is impossible for me to embrace it under the present paper. A very valuable contribution has been given by Mr. Meikle upon this subject, in which he shows how the profit from interest may be ascertained, and how, by a retrospective method of valuation, the progress of the funds of the company may be exactly seen and traced.

I have, however, formed my tables according to the actual rate of interest adopted; and shown, where possible, a comparison between 3 per-cent and 4 per-cent values.

In order to prove that the loadings of the premiums at the different ages have a very important influence upon the results of distribution of profits, I have investigated the subject in the following manner:

1st. By reference to the Valuation Returns to the Board of Trade, I have scheduled the particulars with regard to the offices included under the investigation in the following manner:

a. Basis of valuation.

b. Rate of interest.

c. Period of valuation.

d. Method of distribution.

e. Reserve for expenses.

I have also noted the rate of interest realized and the rates of actual expenses. The last two, however, will not enter into the question of my paper, but would be very valuable in judging critically the results of valuation and distribution of a particular company.

These particulars I wrote upon a separate card for each office; on the other side of the card I inserted the premiums actually charged at ages 15, 20, 25, 30, &c., up to 60; from these I deducted the net premium according to the valuation basis, the remainder representing the full loading—from this full loading I then deducted a fixed charge for expenses estimated, by taking a constant of 5*s*. and 5 per-cent on the gross premium, the balance representing the profit margin as follows:

Let P_x = office premium,
π_x = net premium,
ϕ_x = loading,
e_x = expenses,
Δ_x = margin for profit;

then
$$\phi_x = P_x - \pi_x,$$
$$e_x = \cdot 25 + \cdot 05 P_x,$$
$$\Delta_x = \phi_x - e_x.$$

These particulars enabled me to classify those offices adopting the same method of distribution and the same method of valuation. The following tables will give some of the results:

TABLE A.—H^M 3 *per-cent Net-premium Valuations.—Profit Margins.*

20	25	30	35	40	45	50	55	60
·092	·144	·187	·206	·206	·139	·106	·199	·284
·097	·148	·191	·209	·248	·218	·249	·424	·634
·152	·195	·225	·228	·248	·191	·181	·290	·413
·168	·187	·210	·233	·260	·290	·320	·345	·449
·192	·223	·235	·225	·205	·175	·141	·274	·472
·227	·175	·191	·209	·225	·226	·266	·369	·528
·239	·266	·282	·292	·292	·274	·261	·329	·385
·294	·279	·262	·245	·225	·206	·189	·171	·152

Table B.—H^M $3\frac{1}{2}$ *per-cent Net-premium Valuations.—Profit Margins.*

20	25	30	35	40	45	50	55	60
·194	·252	·297	·330	·369	·347	·382	·558	·778
·233	·264	·297	·334	·380	·442	·524	·625	·753
·233	·291	·348	·381	·424	·403	·459	·443	·410
·241	·274	·292	·326	·365	·411	·469	·538	·623
·265	·303	·328	·323	·328	·272	·247	·348	·441
·284	·243	·325	·342	·365	·386	·405	·424	·433
·289	·503	·320	·345	·376	·415	·473	·542	·643
·419	·438	·440	·437	·431	·391	·386	·562	·778

Table C.—H^M 4 *per-cent Net-premium Valuations.—Profit Margins.*

20	25	30	35	40	45	50	55	60
·260	·341	·387	·472	·557	·574	·681	·988	1·394
·291	·361	·405	·477	·525	·590	·681	·691	·614
·295	·361	·420	·452	·509	·495	·542	·738	·966
·300	·345	·401	·472	·564	·689	·859	1·091	1·365
·362	·412	·448	·465	·502	·526	·609	·596	·590
·398	·412	·432	·452	·482	·515	·550	·584	·824

Table D.—*Carlisle* 3 *per-cent Net-premium Valuation.—Profit Margins.*

20	25	30	35	40	45	50	55	60
−·051	−·013	·023	·062	·112	·173	·253	·386	·560
−·030	·049	−·001	·054	·127	·347	·506	·779	1·161
·010	·066	·134	·208	·310	·422	·601	·901	1·320
·101	·126	·142	·177	·238	·259	·355	·430	·505
Carlisle $3\frac{1}{2}$ *per-cent Net-premium Valuation.*								
·107	·188	·206	·240	·284	·421	·560	·540	...

TABLE E.—*Gross-premium Valuation.*—H^M $3\frac{1}{2}$ *per-cent Gross Premium.*

	20	25	30	35	40	45	50	55	60
1.—Profit Margins contained in Loadings.									
Margin in Loading .	·201	·240	·272	·303	·333	·355	·409	·558	·742
Margin by Valuation	·012	·046	·087	·137	·198	·279	·387	·545	·757
Profit anticipated .	·189	·194	·185	·166	·135	·076	·022	·013	...
2.—Profit Margins reserved under Valuation by percentage of Premium.									
Margin in Loading .	·450	·491	·515	·532	·537	·503	·439	·303	·084
Margin by Valuation	·108	·149	·198	·256	·328	·417	·529	·673	·866
Profit anticipated .	·342	·342	·317	·276	·209	·086	...	...	...
Carlisle 3 *per-cent Gross Premium.*									
Margin in Loading .	·255	·196	·184	·217	·258	·371	·439	·422	·393
Margin by Valuation	·112	·139	·181	·238	·712	·409	·530	·694	·914
Profit anticipated .	·143	·057	·003	...	...	...	...	...	...

Tables A, B, C, D, E, represent groups of offices adopting the same method of valuation, showing simply the profit margins calculated in each case, as explained above.

In examining these tables, it must be borne in mind that under Tables A, B, D, and E, the rate of interest being 3 or $3\frac{1}{2}$ per-cent, there will be profit from interest in addition to the margin of loading, but that under Table C, the rate assumed being 4 per-cent, the interest profit will, probably, be very small.

The principal point of interest in these tables is, the great variation in amounts at different ages.

The next set of tables (pp. 396-399) show how the method of distribution of profits compares with these profit margins. They require some explanation in order that they may be clearly understood.

Under each table a selection has been made of offices in which, at their last valuation, the basis of valuation given was actually

TABLE F.—*Selection of eight different Companies all adopting the Method of Distribution.—Reversionary Bonus to Sum*

	Basis of Valuation adopted	20		25	
	Net Premium				
Amount of Profit Margin under Table adopted in Valuation after deducting from Gross Premium charged	Carlisle 3 %	−·030	...	−·049	...
1. The Net Premium.	„ 3 %	−·051	...	−·013	...
2. Allowance for Expenses, 5 per-cent on Gross Premium and a Constant of 5*s.* per £100 assured.	„ 3½ %	·107	...	·188	...
$\Delta_x = \phi_x - e_x$	H^M 3 %	·168	...	·187	...
	„ 3 %	·192	...	·223	...
	„ 3½ %	·194	...	·252	...
	„ 3½ %	·233	...	·291	...
	„ 3½ %	·419	...	·438	...
		3 %	4 %	3 %	4 %
	...	− ·693	−·588	−1·082	−·926
	...	−1·178	−·999	− ·287	−·246
Present Value for Life of Profit Margin, H^M 3 per-cent and 4 per-cent.	...	2·471	2·097	4·154	3·553
	...	3·880	3·292	4·132	3·534
$(1 + a_x)\Delta_x$	...	4·435	3·763	4·906	4·214
	...	4·481	3·802	5·569	4·762
	...	5·382	4·566	6·431	5·499
	...	9·678	8·212	9·672	8·278

Total Cash, £23·755 for Division of Profit.

Quinquennial

		20		25	
		Cash	Bonus	Cash	Bonus
1st. Cash Value and Bonus	...	1·790	5	1·960	5
2nd. Cash Value and Bonus	...	1·960	5	2·145	5
3rd. Cash Value and Bonus	...	2 145	5	2·355	5
4th. Cash Value and Bonus	...	2·355	5	2·585	5
5th. Cash Value and Bonus	...	2·585	5	2·830	5
6th. Cash Value and Bonus	...	2·830	5	3·095	5
7th. Cash Value and Bonus	...	3·095	5	3.360	5
8th. Cash Value and Bonus	...	3·360	5	2·860	4
9th. Cash Value and Bonus	...	1·388	2	...	...
10th. Cash Value and Bonus	...	...	...	...	...

Roughly limiting to expectation

Present Value of all Bonuses, $\frac{R_x}{D_x}$	...	7·083	7·448
Total of Cash Values during Expectation of After-lifetime	...	21·508	21·190
Total Bonuses	...	42	39

same method of Distribution and the basis of Valuation as stated.

Assured, assuming a Bonus of £1 per-cent per Annum.

30		35		40		45		50		55		60	
−·001	...	·054	...	·127	...	·347	...	·506	...	·779	...	1·161	...
·023	...	·062	...	·112	...	·173	...	·253	...	·386	...	·560	...
·206	...	·240	...	·284	...	·421	...	·560	...	·540	...	...	...
·210	...	·233	...	·260	...	·290	...	·320	...	·345	...	·449	...
·235	...	·225	...	·205	...	·175	...	·141	...	·274	...	·472	...
·297	...	·330	...	·369	...	·347	...	·382	...	·558	...	·778	...
·348	...	·381	...	·424	...	·403	...	·459	...	·443	...	·410	...
·440	...	·437	...	·431	...	·391	...	·386	...	·562	...	·778	...
3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %
−·028	−·018	1·058	·928	2·311	2·044	5·760	5·170	7·539	6·831	10·204	9·425	12·990	12·180
−·481	−·416	1·215	1·066	2·038	1·803	2·871	2·577	3·769	3·415	5·056	4·670	6·272	5·880
4·305	3·728	4·704	4·128	5·168	4·572	6·988	6·272	8·344	7·560	7·074	6·534	...	...
4·389	3·801	4·566	4·007	4·732	4·186	4·814	4·321	4·768	4·320	4·519	4·174	5·028	4·714
4·911	4·253	4·410	3·870	3·731	3·300	2·905	2·607	2·101	1·903	3·589	3·315	5·286	4·956
6·207	5·375	6·467	5·676	6·716	5·940	5·760	5·170	5·691	5·157	7·309	6·751	8·713	8·169
7·273	6·298	7·465	6·553	7·716	6·826	6·689	6·004	6·839	6·196	5·893	5·360	4·592	4·305
9·196	7·876	8·565	7·516	7·844	6.939	6·490	5·825	5·751	5·211	7·362	6·800	8·713	8·169

Bonus, £45 apportioned to 9 Policies at above ages.

Bonuses.

30		35		40		45		50		55		60	
Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus
2·145	5	2·355	5	2·585	5	2·830	5	3·095	5	3·360	5	3·635	5
2·355	5	2·585	5	2·830	5	3·095	5	3·360	5	3·635	5	3·885	5
2·585	5	2·830	5	3·095	5	3·360	5	3·635	5	3·885	5	3·260	4
2·830	5	3·095	5	3·360	5	3·635	5	3·885	5	2·418	3	...	...
3·095	5	3·360	5	3·635	5	3·068	4	·787	1	...	...	...	...
3·360	5	3·635	5	2·268	3	...	...	...	...	...	...	...	...
3·365	5	1·492	2	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...

for Number of Participations.

7·757	8·004	8·158	8·168	8·057	7·681	7·148
20·005 35	19·352 32	17·773 28	15·988 24	14·762 21	13·298 18	10·780 14

Table G.—*Selection of six different Companies all adopting the Method of Distribution in proportion to Premium Paid since*

		Basis of Valuation adopted	20		25	
Amount of Profit Margin under Table adopted in Valuation after deducting from Gross Premium charged		Net Premium				
1. The Net Premium.		H^M 3 %	·092	...	·144	...
		„ 3 %	·152	...	·195	...
		„ 4 %	·260	...	·341	...
		„ 4 %	·398	...	·412	...
2. Allowance for Expenses, 5 per-cent on Gross Premium, and a Constant of 5*s.* per £100 assured.	Load. Margin Valuation „	„ 4 % (Gross)	·201	...	·240	...
			·012	...	·046	...
	Load. Margin Valuation „	H^M 4 % (Gross)	·450	...	·491	...
$\Delta_x = \phi_x - e_x$			·108	...	·149	...
			3 %	4 %	3 %	4 %
Present Value for Life of Profit Margin.		...	2·125	1·803	3·182	2·721
		...	3·673	3·116	4·309	3·685
		...	6·006	5·096	7·536	6·444
		...	9·194	7·801	9·105	7·786
$(1 + a_x)\Delta_x$		...	4·643	3·939	5·304	4·536
		...	·277	·235	1·016	·869
		...	10·395	8·820	10·851	9·279
		...	2·495	2·117	3·292	2·816

To divide Cash £25

Quinquennial

		20		25	
		Cash	Bonus	Cash	Bonus
1st. Cash Value and Bonus	...	1·397	3·897	1·618	4·126
2nd. Cash Value and Bonus	...	1·397	3·562	1·618	3·769
3rd. Cash Value and Bonus	...	1·397	3·255	1·618	3·446
4th. Cash Value and Bonus	...	1·397	2·975	1·618	3·139
5th. Cash Value and Bonus	...	1·397	2·710	1·618	2·863
6th. Cash Value and Bonus	...	1·397	2·472	1·618	2·621
7th. Cash Value and Bonus	...	1·397	2·263	1·618	2·410
8th. Cash Value and Bonus	...	1·397	2·081	1.294	1·809
9th. Cash Value and Bonus	...	·559	·805	...	...
10th. Cash Value and Bonus	...	...	...	...	...

Roughly limiting to Expectations

Present Value of all Bonuses, assuming the total to be an additional Sum Assured at Age at Entry	...	7·903	8·657
Total of Cash Values	...	11·735	12·620
Total Bonuses	...	24·020	24·183

same method of Distribution and the basis of Valuation as stated.

Last Valuation, assuming Cash Profit to divide of £25.

30		35		40		45		50		55		60	
·187	...	·206	...	·206	...	·139	...	·106	...	·199	...	·284	....
·225	...	·228	...	·248	...	·191	...	·181	...	·290	...	·413	...
·387	...	·472	...	·557	...	·574	...	·681	...	·988	...	1·394	...
·432	...	·452	...	·482	...	·515	...	·550	...	·584	...	·824	...
·272	...	·303	...	·333	...	·355	..	·409	...	·558	...	·742	...
·087	...	·137	...	·198	...	·279	...	·387	...	·545	...	·757	...
·515	...	·532	...	·537	...	·503	...	·439	...	·303	...	·084	...
·198	...	·256	...	·328	...	·417	...	·529	...	·673	...	·866	...
3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %	3 %	4 %
3·908	3·384	4·037	3·543	3·749	3·316	2·307	2·071	1·579	1·431	2·606	2·407	3·180	2·982
4·702	4·072	4·468	3·921	4·513	3·992	3·170	2·845	2·696	2·443	3·799	3·509	4·625	4·336
8·088	7·004	9·251	8·118	10·137	8·967	9·528	8·552	10·146	9·193	12·942	11·954	15·560	14·590
9·028	7·819	8·859	7·774	8·772	7·760	8·549	7·673	8·195	7·425	7·650	7·066	9·228	8·652
5·684	4·923	5·938	5·211	6·060	5·361	5·893	5·289	6·094	5·521	7·309	6·751	8·310	7·791
1·818	1·574	2·685	2·356	3·603	3·187	4·631	4·157	5·766	5·224	7·139	6·594	8·478	7·948
10·763	9·321	10·427	9·154	9·773	8·645	8·348	7·494	6·541	5·926	3·969	3·663	·941	·882
4·138	3·583	5·071	4·403	5·969	5·280	6·922	6·213	7·882	7·141	8·816	8·143	9·699	9·093

represents Bonus £45,371.

Bonuses.

30		35		40		45		50		55		60	
Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus	Cash	Bonus
1·838	4·282	2·059	4·385	2·426	4·707	2·794	4·945	3·382	5·478	4·191	6·244	5·295	7·307
1·838	3·915	2·059	3·995	2·426	4·294	2·794	4·562	3·382	5·039	4·191	5·783	5·295	6·830
1·838	3·566	2·059	3·644	2·426	3·931	2·794	4·163	3·382	4·667	4·191	5·406	4·426	5·431
1·838	3·253	2·059	3·336	2·426	3·615	2·794	3·855	3·382	4·362	2·515	3·121	...	...
1·838	2·977	2·059	3·067	2·426	3·347	2·794	3·604	·676	·859	...	...	...	...
1·838	2·738	2·059	2·841	1·456	1·925	...	...	...	...	...	...	...	...
1·838	2·536	·824	1·104	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...

for Number of Participations.

9·120	9·598	10·277	10·924	11·549	12·723	13·169
12·886	13·178	13·586	13·970	14·204	15·088	15·016
23·267	22·372	21·819	21·129	20·405	20·554	19·568

adopted, and the method of distribution under which they are classed was actually applied.

I have then shown, by taking the actual rates charged by these selected companies at various ages,—20, 25, 30, &c.,—what profit margin is left after deducting net premium and allowance for expenses.

Taking this profit margin, I have shown its present value at the commencement of the assurance; and if we assume that the net premiums will be required to meet the liability of the sum assured, and the allowance for expenses will be absorbed for expenses, then this present value represents the probable profit contribution under the rates charged at different ages.

An examination of these values will show how very greatly the rates charged at different ages must influence the result.

Then by examining the lower part of the tables, and applying the method of distribution of profits by the apportionment of a bonus, it will be seen,

1st. How far each bonus may be said to represent fairly the contribution.

2nd. How the present value of all the bonuses compares with the present value of profit margins.

It will be seen that in some cases the method of distribution is quite consistent with the contributions: in other cases it would appear to be most inequitable.

Table F gives a selection of eight different companies adopting the method of distributing profits by a percentage upon the sum assured.

Assuming that the bonus rate will be £1 per-cent per annum, I have shown that the present value of such a bonus is nearly a constant, calculated by the formula $\frac{R_x}{D_x}$.

When this value is compared with the present value of the profit margins, calculated both at 3 per-cent and 4 per-cent, it will be seen that the different premiums charged have an important bearing upon the method of distribution.

Offices may, under this method of distribution, give large profit throughout life to those entering at the young ages, although the premiums are so low that there is no margin contributed. In other cases the method would appear to be fairly equitable, but in every case the loading would be an important element for estimating whether the profit distributed was at all in

proportion to the contribution towards it contained in the premium; and, applied indiscriminately, it would not do justice to all.

Table G gives a selection of six companies distributing their profits in proportion to the premiums paid since last valuation. The value of all bonuses upon this basis will show an increasing value as the age at entry increases, but bonuses decreasing in amount the longer the policy remains in force. It gives the advantage to lives entering at the older ages.

These two tables are sufficient to show the striking variations of profit margins contained in the premiums, and the effect they must have upon the method adopted in distributing the profits. A further investigation of every other method shows similar differences. The following are the general conclusions which I have formed:

I.—That the loadings, included in the premiums charged, have a most important bearing upon the valuation of a life office and upon the method of distributing the profits.

II.—The basis of valuation can generally be more easily adjusted or altered than the rates of premium charged, or the method of distribution of profits. Before such basis is determined, therefore, it is desirable that the effect of the loadings should be investigated. It may be found that they show an insufficient margin for future expenses and profits, In that case a reserve should be made over and above that brought out by a net premium valuation—or if the loadings are found to be inconsistent with the method of distribution of profits, such steps should be taken as will bring into harmony the three prime elements—rate charged, basis of valuation, and distribution of profits.

III.—No absolute rule can be safely laid down as to a basis of valuation to be adopted by all companies; neither can one particular basis be selected as that which should be generally accepted by the public, as the strongest, or best, or most satisfactory.

Generally, any actuarial investigation of the liabilities of a life office should include an examination of the relation which exists

between the three principal elements involved, namely, the loadings of the premiums, the mode of distribution, and the methods of valuation; and whenever one or more of these are fixed, either by deed of settlement, custom of the office, or otherwise, the necessary adjustment should be made in the others to make the three work in harmony and equity.

Discussion.

The President (Mr. T. B. Sprague) having invited observations,

Mr. James Chisholm said that it appeared to him that Mr. Crisford wished to take a broad view of the actual facts, and for that reason he had taken the basis of valuation actually adopted by each office and the premium based upon that valuation. But while that might be a fair enough way in some respects, it would not answer all purposes. If Mr. Crisford wanted to show that certain offices were doing business at too low rates, then perhaps it might be fair to admit the method which he had adopted. If, on the other hand, Mr. Crisford's object was to compare the profit loading at different ages of entry in a particular company, he did not agree with the methods adopted for that purpose; it really was essential that the true risk premium should be taken as a guide. If Mr. Crisford contended that at a particular age, say 20, the loading thrown off for profit was much smaller than it ought to be, and at another age it was much larger than it ought to be, the counter contention would be that it was incorrect to argue in that way unless they dealt with the true premiums.

Mr. G. H. Ryan, referring to the statement made by Mr. Crisford, that whereas under some circumstances the effect was to bring out a lower reserve by the employment of the reinsurance method, yet there were other circumstances under which the reserve would be higher, remarked that that would probably be found to be the case when the reversionary bonuses attaching to a company's policies were proportionately large. As bearing somewhat on the point, Dr. Farr had valued the Equitable Society by the Northampton and Carlisle Tables, adopting the same rate of interest in both cases, and he found the result was practically the same under both methods and conditions. He traced this result to the effect of the large reversionary bonus that existed on the policies. The Northampton Table gave a larger value to the reversionary bonuses, and a smaller value to the policies, whereas the Carlisle Table gave a larger reserve for policies, and a smaller for the reversionary bonuses. An objection to Mr. Crisford's course of action in his present investigation would be that, whereas he treated all companies individually, as requiring different methods of valuation —that is to say, he assumed for this purpose that every company possessed a distinctive organization—he nevertheless assumed that the companies could be considered to incur the same rate of expense. That seemed a fundamental objection to the system that he had adopted,

for some offices had a delicate constitution and could not stand a very high rate of expense, whereas others were more hardy and robust, and had proved themselves able to look on a heavy rate of expense with comparative equanimity. As to the explanation given by Mr. Crisford of the Table E in his paper, although he had pointed out that where the gross premium valuation was made the profit was anticipated up to a certain point, he had not continued his argument to its legitimate conclusion, and shown that after that point had been reached the margin of loading, according to the gross premium valuation, would be larger than that under the net premium method. It was perhaps necessary for the completeness of the argument that this condition should be stated.

Mr. W. T. Gray said that a good deal of discussion might arise as to the method of assessing expenses which Mr. Crisford had taken. He assumed 5 per-cent of gross premium, and 5*s*. per-cent on the sum assured; but he left out of the question entirely the actual rate of interest that the company made on its funds. Some authorities had suggested that all the interest beyond that assumed in the valuation might be very properly applied towards payment of expenses; and if the expenses, or some portion of them, were wiped out by this surplus interest, it was quite possible that many offices which now appeared to have such different margins of loading on their premiums might have the same, or approximately the same, margin of loading at all ages. Undoubtedly a different apportionment of the expenses to that assumed by Mr. Crisford would make a very great difference in the figures throughout his paper.

Mr. Stanley Day thought that Mr. Crisford had shown what they had often heard in this room, that the three subjects of premiums, valuation, and distribution should not be considered apart. He had also shown that the premiums were the least difficult to change of the three, so that they should take them as the standard. He had referred to the hypothetical method of valuation, and said it brought out very uncertain values, but he did not know that that was altogether the case. The greatest difficulty about the hypothetical valuation was that it brought out wrong values for the sums assured, and wrong values for the premiums. The two more or less correct themselves. There was a method which he had not referred to, advocated by Mr. J. A. Higham, that took the office premiums as the standard, and valued the difference of these, the office premiums, by a true annuity. That would meet Mr. Crisford's case more nearly than some of those which had been referred to, for it used the true premium and the true annuity-value. The only difficulty about it was that not many offices could stand it. Mr. Higham had referred to this in some remarks printed in the *Journal* (*J.I.A.*, xxii, 43).

Mr. T. G. Ackland thought it of interest that attention should be directed to the relation which the premiums in the prospectus have to the methods of valuation and distribution. There had been some remarks made as to the reinsurance method of valuation, and Mr. Ryan had referred to the author's remarks in the early part of the paper, and assumed that it had reference to reversionary bonuses. He failed to see how the bonuses entered into the question. In vol. xi of the *Journal*, a paper was contributed by the present

President (Mr. Sprague) criticizing the reinsurance method, and pointing out that (apart from bonus altogether) the reinsurance method under certain conditions of loading gave a less value than the net premium, and under other conditions gave a greater value, and under yet different conditions gave an equal value. The question of reversionary bonuses certainly did not enter into the questions referred to in that paper. Mr. Day had referred to the method of valuing by the difference of the gross premiums valued by the true annuity, and it might be of interest to refer to this, although in that case it was not difficult to see what the reserve for future expenses and profit would be. Under the reinsurance method of valuation, however, there was some difficulty in arriving at the true value of the reserve for future expenses and profits. Mr. Tucker gave an expression for this reserve (*J.I.A.*, x, 312), and in a succeeding paper Mr. Sprague had questioned whether the result should not be differently expressed. The difficulty appears to be that under the reinsurance method, the premiums being valued by a hypothetical annuity, it was very difficult to say what the true reserve for expenses and profits was unless some assumptions were made as to mortality and interest. The moment they did that they could at once arrive at an expression for this reserve; but the reinsurance method did not involve any such assumptions, but accepted the premiums as they were, and valued upon their basis. He thought Mr. Crisford wished the meeting to consider, as actuaries, that the all-important considerations were the proper reserves, firstly, for future expenses, and secondly, for future bonuses. The other point—which actuaries had hitherto been in the habit of considering as most important—that is, the reserve for the sum assured, appeared to be considered as somewhat of a subsidiary nature. On a previous occasion, it was remarked that Mr. Crisford's results would be very materially affected by the actual rate of interest realized by the several companies. That was a very important factor; for if an office made 4 per-cent and valued at 3 per-cent, the profit-interest was not a matter that could safely be neglected in arriving at such results as had been laid before the meeting. The assumption of a uniform rate of expense had also been referred to, and of course that very materially affected the matter. An office with low premiums and low expenses would be in a totally different position from a company with the same low premiums but incurring a much heavier rate of expense.

Mr. Ryan explained that the remark he made with respect to the operation of the hypothetical method did not have reference to the paragraph alluded to by Mr. Ackland, but to an interpolated statement made by Mr. Crisford that he had actually valued some offices by that method, with the results as stated.

Mr. H. W. Manly said that Mr. Ackland clearly expressed his feelings when he stated that Mr. Crisford appeared to have thought that there were two elements in a valuation which were paramount, namely, to make a reserve for the expenses and a reserve for bonuses, and that the reserve for the sums assured was quite subsidiary. He had always thought that the reserve for the sums assured was most important. When asked to make a valuation the actuary had to consider the liabilities in the shape of the sums assured in the first

instance, and then to consider what he had to meet those sums assured with, in the second. Those who upheld the pure-premium method of valuation stated that the payments should be divided into two parts at least, the first part to meet the sum assured, and the second part to provide for the expenses and bonuses; and, further, that the first part or the mathematical premium—that part which ought to be put aside to accumulate to meet the sums assured—should depend upon the actual mortality experienced, or likely to be experienced, by the society, and the actual rate of interest which it was to receive upon its investments. Mr. Crisford seemed to take a totally different view of the position of affairs. He said that first they should take the premiums charged, no matter whether large or small; that from those premiums they must deduct a certain constant and percentage for the expenses, and that if the balance did not provide for the sum assured, why, they must contrive to make it do so. He should not like such a statement to go forth without a protest. He wished to express the opinion most emphatically, that if the premium was not large enough to meet the sum assured and expenses, then no manner of manipulation in the valuations could ever make the office a sound one. Again, Mr. Crisford said no absolute rule could be safely laid down as to the basis of valuation to be adopted by all the offices. He arrived at that conclusion from the fact that offices charging different premiums might adopt the same method of distribution; but he (Mr. Manly) thought, with all due deference, that this conclusion was untenable. He had said it was more easy to adjust the basis of valuation than either the premiums charged or the method of distribution, and he enforced upon them that if the premiums were not loaded in such a manner as to meet the system of expenditure and distribution of profits, they ought to adjust the valuation to that system. Now, he considered that they ought really to adjust the premiums to that system. No matter what system of valuation was adopted, they could never make the system of distribution equitable when the contributions were not equitably adjusted to the benefits to be received. There was no doubt, as Mr. Crisford said, that the public were induced to go to those offices which charged very low premiums. When he (Mr. Crisford) read the first part of his paper, he produced a scale of very low premiums which he had abstracted from various offices, and which, in the general opinion of the members then present, were, he (Mr. Manly) thought, actually below what might be considered the scale at which an office could safely conduct its business at the present rates of interest and expenditure. Mr. Crisford was inclined to support the reinsurance method, provided its effect was known. One of the great objections to this method of valuation was that the results were not known, and never could be known. The general body of actuaries were unable to state whether such a valuation brought out a satisfactory reserve or not, and as the valuation should be made as much for the benefit of the public as of others, such methods of valuation should be adopted as were really intelligible to the general body of persons giving attention to these matters.

Mr. M. N. Adler observed that Mr. Crisford gave the results of his first paper (*J.I.A.*, xxv, 184) in the three propositions that he laid down at the outset of the present contribution. The first conclusion

was, "The actual rates charged by a company should always be taken into consideration before determining the principle to be adopted in a valuation." That observation might be almost taken as a truism, as well as the second that "Under a net premium valuation it is quite possible that an insufficient reserve may be made for future expenses and profits when the premiums, either on the whole or at special ages, are low." The third was "The security of a company, and the margin of profits-reserve can only be ascertained by a careful examination of the actual premiums charged at different ages when placed side by side with the method adopted in the valuation." This, and some arguments in the course of the paper, must certainly be regarded as shots fired at the pure-premium method of valuation. It was true that it was a very proper thing to bring out the results of a gross-premium valuation—the actual premiums charged ought not to be altogether ignored; but he failed to see any novelty in Mr. Crisford's recommendations; nor could he see any practical application in the second portion of his third proposition, "that the basis adopted in a valuation is not an unfailing test of the stability of the office." The first of the general conclusions of the second portion of the present paper was, "That the loadings, included in the premiums charged, have a most important bearing upon the valuation of a life office, and upon the method of distributing the profits." This was very similar to one of the propositions of the former paper, and no one would be disposed to dispute it. With regard to the second proposition, "That, as it usually is the case that the basis of valuation can be more easily adjusted or altered than either the premium charged or the method of distribution, it is desirable that the effect of the loadings should be investigated before determining on the basis of valuation to be adopted", he would like to see some practical method given as to how to solve the problem. Having found peculiar features with regard to the loading, or ascertained its curve, what should be the method of valuation in consequence? He would have been glad for some practical suggestion as to what they should do in the way of adjusting valuations so as to give effect to the peculiar features shown by the loading, without disturbing the method of distribution.

The President (Mr. T. B. Sprague), referring to the assumption of a common rate of expense for all companies, said if they used in their calculations the elements of actual practice, the rate of expense was one of the most important of all. They might take, as Mr. Crisford had done, the premiums charged by 56 different companies, and work out certain results from them; but if they did not take into account the various rates of expense, the results would be of little practical value. In the same way the rate of interest realized by each company had a most important bearing on its finances, and if the object was to discover the truth, not only the actual premiums and the actual expenses, but also the actual rate of interest, must be taken into account. He did not gather for what object Mr. Crisford proposed to have a classification of policies according to the age at entry. That was a novel idea to him. Mr. Crisford had made a remark in which several members had joined, to the effect that when premiums were low at a certain age the public flocked in to effect assurances with that office; but he (Mr. Sprague) did not credit the public with so much

sagacity. As to Mr. Crisford's statement that it was easier to alter the basis of valuation than either the premiums charged or the method of distribution, he doubted whether that was generally true, as a matter of fact. In the course of his experience he had seen a great many changes in all of these, and they were usually made with very little trouble. The difficulty of making changes of this kind had, he thought, been exaggerated; people were sometimes afraid of making such changes lest they should interfere with vested interests; but very often they were made, and no objection was raised by any person interested in the office.

Mr. G. S. Crisford, in reply, said that, were he to attempt to answer fully all that had been said, he would have to write another paper. But he was not proposing to do that. Some little misconception had arisen as to the general tone of the paper. It was in no sense intended as an attack upon the net-premium method of valuation. It was an endeavour merely to deal with the methods of valuation which were actually adopted by different companies, and to show that the premiums, and the variations in the premiums, greatly modified the results. Mr. Ackland said that he (Mr. Crisford) considered it important that a reserve should be made for expenses, and that in the valuation there should be a certain margin for profit, but that he put as quite subsidiary the question of reserve for the sum assured. That was in no sense correct. He certainly had no intention of assuming that in a valuation the first principles, which should be to make a proper reserve for the liability, should in any way be departed from. Supposing an office was making a valuation upon H^M net-premium basis, those premiums, Mr. Manly said, should be the proper premiums to be set aside; but Mr. Chisholm pointed out that according to this basis of valuation the net premiums which are set aside are not the proper, pure-risk premiums. Mr. Chisholm's view would therefore to a certain extent nullify Mr. Manly's remark to the effect that the pure-premium valuation set aside the proper risk premium. But in every valuation it must be assumed that there was a certain rate to be charged. The liability for the sum assured in all cases must be the very first consideration, whether net or gross. That was the starting point which must be adopted in all cases by all actuaries, and ought first to be considered. But when they came to the premium which was actually charged, they got a very different quantity. In one case they might get a small premium and in another case a high premium; at one age they might get a small premium and at another age a high premium, and so on. Now he did contend that if he wanted to make a valuation of two different companies, one charging high rates and the other low rates, upon H^M 3 per-cent, or $H^{M(5)}$ 3 per-cent, or Selected Life Tables 3 per-cent, whichever basis he adopted, when he came to these two offices, although the liability as regards the sums assured might be identical, the position of those two companies would be very different. It was that which he wished to point out. Mr. Adler said he would have been interested if he (the author) had been able to give a practical method showing how to bring into consideration the second conclusion in his paper (see p. 401). But, inasmuch as every different scale of premiums would require a different method to be adopted, it

would be quite impossible to suggest any general plan. It was for the actuary himself, having the facts before him, to see whether his valuation of the premiums required any adjustment. The President had asked what was the use of a classification of policies at age at entry. The principal use would be to show the proportion of policies included which bore a light loading, and the proportion of policies which had the heavy loading, and to show how far one might feel that any basis adopted would bring out either negative values, if it was a gross-premium method, or have a low margin under a net-premium valuation, as the case may be. Grouping policies together according to ages at entry would help such investigation. If the loading at any particular age happened to be very low, then a classification of the policies according to age at entry would be useful to indicate where it would have the greatest influence upon the valuation.

On the Assessment of Life Risks. By James Chisholm, *Fellow of the Institute of Actuaries, Manager and Actuary of the Imperial Life Insurance Company.*

[Read before the Institute, 29 March 1886.]

By the assessment of life risks, I mean the gathering together all the scattered influences that bear on the duration of life of particular individuals; the connoting in the mind the weight to be attached to the several factors that make up such influences; and, finally, the fixing the price of assurance for each individual life which approximately puts all upon a level.

This is the ideal that all companies aim at in conducting the business of life assurance. How far they succeed in attaining it—if, indeed, it be possible of attainment—and how far we are at present on the right track in our methods and our practice, we shall endeavour to discuss in the following paper.

In the early days of life assurance, the acceptance of risks was a comparatively simple matter. No medical examination was considered necessary. The family history even was not enquired into, or, if at all, only very superficially. The applicant had to appear before the board of directors, and it was sufficient if his build, mode of life and apparent good health, together with the object and the amount of the assurance, satisfied their common-sense notions, that he was a first-class life and that the risk was in all respects a desirable one. We may be inclined to doubt the wisdom of our forefathers and to deride a practice which falls so far short of the requirements of the present day. But I am

heretical enough to think, notwithstanding the advanced stage of scientific precision at which we have arrived, that in some respects we might do well to copy them, and that, with the addition of a statement of the family history, we might accept lives coming to us *under the same conditions that surrounded and safeguarded these early proposals for life assurance,* without the necessity even of a medical examination.

I look upon hereditary influences as the first and most important factor in assessing the value of the life of an individual. They indicate the store of vitality with which he has been endowed at his birth. The member of a family which can only show among its records the havoc of early disease and death must be considered up to middle age a most precarious risk. The hand of death has been fastened upon him from his cradle. He may survive, but he will remain only after a long process of weeding out like a solitary oak in a thicket of underwood, and the exception will only prove the rule. Next to hereditary influences, in order of importance, I place past and present habits and mode of life, occupation, &c. If there is, or have been, nothing in any of these to give rise to the breakdown of any of the vital functions, what additional warrant of the healthiness of an individual can a medical examination give us that is worth while taking into account? I will go so far, even, as to hazard the opinion, that in such cases as I am now referring to, we may only succeed in making ourselves unhappy without much cause if the medical examination discloses some present weakness. The probabilities are, that the disorder, whatever it is, is only functional, that whether it be some irregularity of the heart-beat, or the presence of albumen in the urine, these symptoms are only transient and will pass away. We do not allow sufficiently for the vitality of the race and of the individual member of it before us and frighten ourselves unnecessarily. In the olden days these temporary maladies were never discovered, and I do not think the offices were much worse off in consequence.

I make these remarks because lives who have sprung from a most hardy stock, and whose individual history throughout its whole course, and in all its aspects, is known by the company to be favourable, do constitute a proportion of those presenting themselves for assurance now—a greater proportion, perhaps, with some offices than with others—and we may discredit the cause of life assurance with the public by a too rigid adherence to forms and red tape, when they might easily be relaxed or dispensed with.

The chief drawback to this early mode of assessing risks is that none but first-class lives, beyond all doubt or question, are considered assurable, and under the old practice many might be declined from excess of caution who ought really to have been accepted, and who, on account of some trifling departure from the ordinary type in build or appearance, simply failed to satisfy the exacting standard of the board of directors. Here it is that medical examinations come in to help us, and by a more minute scrutiny of the individual enable us to admit lives from a much wider area and spread the benefits of assurance among many more families. They go further in their effects even than this, for it is when lives depart in any degree from the normal average furnished by the most favourable conditions, that medical examinations become indispensable, and we appeal to the skilled physician to find out for us in what and how far the special weakness consists, and to measure, if he can, what weight ought to be given to it.

I must admit, too, that as, with the advent of steam and electricity, and their attendant train of railways and telegraphs and telephones, the world has become larger, it is not easy to acquire the same close and assured information about risks that is possible when they are derived from a more limited area. We are, to a greater extent, open to be the victims of fraud, and the test of a medical examination is more necessary to guard us, if it be able to do so, against the admission of carefully prepared candidates, who, after having been declined or rated-up by one office, have learned by experience what is necessary to give them the temporary aspect of sound health and robust condition.

It is by a very slow and tentative process that assurance companies have come to accept lives that are in any respect under the average. I do not mean that at a comparatively early date the business of assuring invalid lives was not carried on by one or two individual companies with more or less success, but rather that the practice of accepting such lives by nearly all companies has only become general after a gradual and lengthened process of development.

At first, the existence of certain specific drawbacks in a life, such as hernia, gout in the family, &c., was met by the imposition of a fixed extra charge of 2*s.* 6*d.*, 5*s.*, or 7*s.* 6*d.* Then, side by side with this practice, which continues to the present day, there grew up the custom of separating lives into certain broad classes, namely, those that were above, equal to, or below the average, or

uninsurable on any terms. Next, we find a further step taken, and with the advent of investigations into the mortality of assured life, doctors began to be furnished with tables of expectation, and were asked to state how many years should be added to the life of an individual to make him equal to the average.

As the doctrine of survivals might lead us to expect, we find examples of all these different systems now existing.

I have procured from all companies transacting the business of life assurance in England, whom I now thank for their courtesy, information as to their present practice, and a copy of their form of medical report when they use one.

This information I have carefully analyzed, and the result is shown in the following table:

Analysis of forms of Medical Report in use by British Life Offices.

Description of Report	No. of Companies	
SECTION I.—GENERAL OPINION:		
a. Verbal report only	1	
b. Written report required; no questions asked, and no form supplied	5	
c. The doctor asked to conclude report with a summary of his opinion on the life	8	
d. Specific opinion asked whether life is eligible . .	17	
e. Specific opinion asked whether life is eligible at ordinary rate or with an addition	3	
f. Subdivided opinion required	7	
	—	41
SECTION II.—CLASSIFICATION OF LIVES:		
a. Simple classification without remark	6	
b. Reasons required for specific classification of risk .	5	
c. General opinion of risk required, in addition to classification	2	
	—	13
SECTION III.—ADDITION TO AGE:		
a. Doctor to state number of years to be added . .	7	
b. Doctor to state *terms of acceptance* if life not to be taken at ordinary rate	3	
c. Subdivided opinion, and number of years' addition to age to be stated	4	
d. Classification of life, and number of years' addition to age to be stated	14	
e. Subdivided opinion, classification of life, and number of years' addition to age to be stated	2	
	—	30
	Total	84

NOTE.—In all divisions of the foregoing table, except Section I, *a* and *b*, the medical examiner is furnished with a form of report, containing detailed questions as to past illnesses of applicant and the condition of the various organs.

We see that there has been a gradual advance in the precision of the terms in which the opinion of the medical examiner is demanded. This can easily be traced in the varying degrees of definiteness with which the question is asked in the various medical forms. In one or two cases still, the doctor makes simply a verbal report of the result of his examination and of the recommendation he makes, and no written record of this is kept beyond what the officials may jot down for their own satisfaction. This practice, it will be understood, can only obtain when the lives are examined at the head office of the company, and, probably, none but such lives are ever accepted. In a few other cases, the doctor is simply asked to give his general opinion of the life in the form of a letter, without any heads being set down for his guidance in reporting the information he elicits, either as to the past illnesses of the proposer or as to the state of his different organs. In most cases, however, a form is supplied in which are set down a great number of questions relating, in more or less detail, to these two subjects. I do not propose to refer further to this part of the form, as it is one which is fitted for discussion exclusively from a medical point of view, but I wish to call particular attention to the great variety of form in which the final opinion of the medical examiner is asked. To proceed from the simpler to the more complex forms, we may begin with the simple question: Is the life eligible? soon to be followed with ever-increasing definiteness by—Is he strictly eligible? Is he in all respects as likely to live to old age as most healthy persons of his age? Is he eligible at ordinary rates, or with an addition? If not an average life, to what extent is the assurance precarious?

Then comes a series in which the doctor is asked to give his opinion in separate divisions, as if the companies were afraid he would forget one or other of them;

1. As to present health.
2. As to the state of the different organs.
3. As to the constitution.
4. As to family history.
5. As to effects of a past or future tropical residence.
6. As to eligibility.

The next section comprises the companies which classify their lives without asking the doctor more particularly how he would adjust the differences between the several members of each class. The following is a fair sample of the classification employed:

I. Unexceptionable lives and lives to whom the objections are so trifling as to be no bar to acceptance at the ordinary rate.

II. Lives fairly good to be charged a small extra premium.

III. Hazardous lives to be charged a considerable extra premium.

IV. Uninsurable lives.

The last section comprises those companies which ask the doctor to state how many years should be added to the age to compensate for the extra risk. Very frequently a table of expectation of life is furnished to guide the doctor in his decision. This final limit of precision is sometimes employed in conjunction with the forms used in the other two sections—that is to say, the doctor is asked to give his opinion in so many subdivisions or to classify the life, and in either case to specify the number of years to be added to age. Two offices go so far as to require a subdivided opinion in five sections, a separation of the life into one of four classes, and, finally, a specification of the number of years to be added to the age.

Is it not possible that, with all this affectation of precision in a matter which is not capable of it, we may not be concealing our own ignorance and misleading ourselves very much in our practice?

If we consider the infinite variability of the conditions (by which I mean, ancestry, personal history, and circumstance) that surround every individual, I think we shall be inclined to admit the *à priori* improbability of our being able to assign the value to be given to a particular life, except in a very rough and approximate way. In the addition of so many years to the age there is involved the assumption, that the rated-up life will follow the same average course as a life of the assumed actual age, that the chances of mortality will act with the same force year by year at each succeeding age in the two cases—that a life of 20, for example, who is rated up 10 years and considered equivalent to a life of 30, will reach his climacteric at an age 10 years younger than the other, and will infallibly be dead at the age of 88 instead of 98, as, in any case, he ought to be according to our tables of mortality. Does this not seem rather an extreme assumption to make? and yet it is all contained in the suggestion of a reference to a table of expectation as a guide in calculating by how many years one life

falls short of another in value. Even if this practice were correct, we should be very apt to be led astray. The expectation of life sums up all the facts of the mortality table. It is a very delicate test and a comparatively small alteration in the expectation may account for a very large difference in the mortality. For instance, the Northampton Table is known to provide for a very much heavier mortality than the Carlisle. At age 20, the rate by the one table is double that by the other; at age 30, it is 70 per-cent higher; at age 40, 60 per-cent higher; and at age 50, the rate is more than double again. No one would, at first, be inclined to suppose that these facts would reconcile with a difference in the expectation of life of eight years at age 20, and of only three years at age 50. In taking the expectation as a guide, we lose sight altogether of the weight with which the mortality falls at particular ages, and we may be led to accept for a diminishing risk an average premium, which, at even a highly rated-up age, would still not yield sufficient to pay for the risk of death in the commencing years of the assurance.

A single illustration will bring out the full importance of this point. There is no defect which so often comes before us in actual practice as the existence of consumption in the family. Let us suppose that an office puts all such lives, if they be under 45 years of age, into a separate category, and invariably rates them with an addition of five years to the age. The theory is perfect. There can be no doubt that these lives, as a class, do fall below the average; the extra of five years is a moderate one, and will, perhaps, be sufficient if the whole class will only keep together and continue the assurances to the end of life in every case. The good among them will pay for those that are bad. But this is very different from what is accustomed to happen. In the first place, all the lives—and these are very likely to be the best among them—who feel themselves to offer the most favourable conditions in respect of present health, age attained, build, and occupation, think it an injustice to be charged an extra to compensate for defects in others, and they move off to some other office which discriminates between the individual lives of a class, and which will accept them at the ordinary rate. The first office is then left with all those in the class who present less favourable conditions of longevity, and whom no other company will accept at the same low average premium. But this is not all. We will suppose that one of these originally under-average lives remains 10 years with the first office, and at the end of that time finds

himself much improved in health and condition. He will be very likely to surrender his policy and walk off with the major portion of the reserve to reassure his life elsewhere at the ordinary rate. It will even, perhaps, not be surprising if the surrender value he receives is based on the reserve at the rated-up age, which will have the effect, practically, of restoring to him nearly all the extra premium he has ever paid, while the company handsomely agrees to charge nothing for the specially heavy risk that it has run.

But, even if the theory were perfect at all points, it would be apt to fail in its application on account of the difficulty any doctor would feel in answering the question in the form that it comes before him. He is, it is true, furnished with a table of expectations. He is told that at age 20 the normal expectation is 42 years; that at age 30 it is $34\frac{3}{4}$ years; at age 40, $27\frac{1}{2}$ years. But does this help him in the least to predicate of the particular individual before him what his normal expectation of life is? Is the doctor a sufficiently skilled actuarial student to understand even what the phrase means? How is it possible for him to connote in his mind all the various possibilities of mortality that may affect a life, and sum them all up in the absolute dictum that his expectation is shorter than the average by so many years?

I can understand that, after a long period of time, a medical man may, from the experience he has gained in examining a great number of lives for assurance, come to set up in his own mind a certain graduated scale according to which he measures all the lives that he examines. But this will be a purely subjective standard, dependent to a great extent on the idiosyncrasies of his mind and on the peculiarities of his experience, and will beget results quite incapable of comparison with those derived from other similar standards, the number and variety of which can only be measured by the number of medical practitioners in the kingdom. I question, too, whether one medical man in a thousand—whether, indeed, with few exceptions, any but those who are attached to the great assurance companies as chief medical advisers, have the opportunity to gather sufficient experience or care to pay attention to this one point among the many that arise in the course of their multifarious practice.

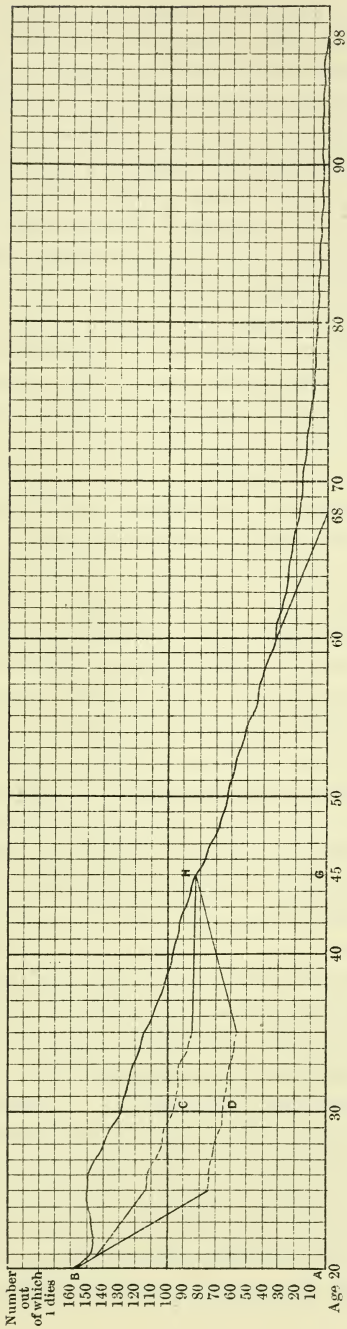
I hold, then, that in asking a medical man to say how many years a life falls short of its expectation, or how many years should be added to the age, we are altogether on the wrong track.

In assessing the value of a life, the first requirement that we are met with is the careful accumulation of data. All the facts of the family history, all the personal illnesses, the conditions of all the organs, must one after the other be set down. This is the true department of the medical examiner. The facts are often by no means simple in their relative importance, or in their bearing on the risk; but the doctor is a skilled and accurate observer and is trained to estimate the damage that an individual has suffered by the inroads of disease. The difficulty in the case first arises when he wishes to convey to the minds of the directors the information that he has obtained and the impression it makes upon him. He can easily report the simple facts—that the life has had such and such an illness, that after careful questioning he is of opinion that one of the parents died from such and such a hereditary disease—but how to put in words the exact feeling in his mind of the way in which and the extent to which the life has deteriorated, is not so simple a matter. The chief medical officer, looking through the papers, may draw certain deductions from the facts; but, indispensable though this be, with the wider experience it brings to bear, it will not make up for the loss of the accurate impressions of the original observer with the life in person before him.

That I may not be blamed for attempting to destroy one method without suggesting another, I beg to submit the following diagram for discussion, as affording the means, at least approximately, of summing up the facts which the doctor has to report.

It is drawn from the numbers out of which one person dies at each year of life according to the H^M experience. The abscissæ represent the successive ages, and the ordinates the numbers out of which one person dies. Thus at age 20 the line *AB* represents 158, because one person out of 158 dies at that age; and the ordinate *GH* at age 45 is just about half the length of the ordinate *AB*, because the rate of mortality is at the latter age almost twice as great as at the former.

DIAGRAM REPRESENTING THE NUMBERS LIVING AT EVERY INTERVAL OF AGE OUT OF WHOM 1 DIES IN A YEAR.



NOTE.—The modified curves *B C H*, *B D H*, are those estimated for lives with a particular family history of consumption as explained in the text.

If, now, we furnish a diagram like this to the medical examiner, and ask him to mark on it at what epoch and to what extent the danger to life consists, he will, I think, be able to do so with some rough approximation to a scientific estimate based on the data before him. Let us suppose the case of a life aged 20, with the following family history:—One brother younger than himself, no sister, father living age 50, mother dead at the age of 44 of consumption—no other case of consumption known in family. Here, I confess, the curve I should draw would greatly depend on the occupation likely to be followed; but in any case, I think I hear the doctor saying, "if he survive to the age of 45, his life will be as good as a normal one." After that age, therefore, we leave the curve unchanged. If the life be, say, a pupil-teacher, subject to hard mental work and confined class-rooms, the risk from now up to the age of 45 would be very considerable. At the moment of entry the life is, of course, select; but in 5 years' time it will enter on a hazardous and unknown course. At a rough guess, we might say that the liability to death is doubled by the conjoint influence of the hereditary malady and the unfavourable occupation. About the age of 35 the prospects of longevity will perhaps begin to improve a little, and at the age of 45 the line joins the normal curve. If the life were a young farmer or land agent, the curve between 20 and 45 would be of the same character as the last, but much nearer the normal one—say midway between the two, or perhaps even higher up. It may be said that these curves are based on mere assumptions. It is true that they are so, but at least the probabilities on which they are based are reasonably framed, and if the curves were drawn by experts in the malady of consumption, we might hope that the probabilities would be represented by a still nearer approach to truth.

In any case, the curve would represent an approximation to the probable line of death. We should see where it was that the risk fell greatest, and we should be able to provide against it by charging a correspondingly heavy premium.

Let us take one more illustration. A man, age 45, has shown symptoms of a gouty diathesis and he has had one or two attacks of rheumatic gout in the feet. He is by occupation a brewer, but he is stated to be strictly temperate. In this case the risk of death will be an accumulating and not a diminishing one. The life will, perhaps, be very little below the normal for a good many years; but there are strong probabilities that it will break down

about the age of 65 to 70. The curve will follow the normal line up to the age of 60, and then make a rapid descent between that age and the age of 68. If we exclude, therefore, the period of fatal development of the risk, and issue a short-term or an endowment assurance, payable at death or at age 55 or 60, the life might be accepted at the normal rate or with a comparatively small addition.

The function of the medical examiner ends with reporting the facts he has elicited, and marking on the diagram his impression of the life. It is not his province to assess the price at which the life should be taken. It is the duty of the actuary to fix the monetary equivalent of the risk based on the facts reported by the doctor, and it is the business of the directors to say whether they will accept the life at that or at any other price. It is the money of the company that is risked on the transaction, and it may very well happen that a particular risk seems to the directors to be too speculative, and they may prefer to be without it at any price; or, taking the facts as reported by the medical examiner, they may think it necessary, knowing that his opinions are only more or less imperfect forecasts of the future, to allow a little further margin for risks of error in fixing the premium; or they may be in possession of information regarding habits which the medical examiner was not aware of, and which detracts from the value of the life; or, finally, the chief medical adviser of the company, with a wider assurance experience and probably special knowledge of particular maladies, may override the opinion of the medical examiner. I refer to this because it sometimes unfortunately happens that the medical examiner inadvertently allows the proposer to gather his opinion that the risk ought to be accepted at the ordinary rate or on such and such terms, forgetting that he has been retained by the company as its professional adviser in the matter and that the opinion he gives is confidential. While I claim this untrammelled liberty of action for the companies, the public may rest well assured that their interests will not suffer. Although it is inevitable that differences of opinion and of practice will arise, competition is too keen to allow of business being lightly refused or rated at too high premiums. The tendency is very often the other way; and lives that might very well be called upon to pay an extra are allowed to pass muster at the ordinary rate, in order that the general growth of the business may not be checked, or a particular agent be discouraged.

It must be admitted, however, that there is far less uniformity

of practice than might have been expected from the accumulated business experience of 100 years. When it continually happens that very different extras are imposed by offices for the same risk, and that a life declined by one office is sometimes immediately accepted by another, it is not surprising that the public should come to think that terms of acceptance are altogether a matter of bargaining and to disbelieve in the existence of any principle at all on which rates are fixed.

I believe that the great dissimilarity in the medical report forms is answerable, to a very considerable extent, for differences in practice. The doctors themselves are, in the first instance, it is easy to imagine, very much puzzled and confused by the multitudinous ways in which their opinion is asked. They must often wonder what it is that the offices want to know, and it is conceivable that the same doctor might convey different impressions of the same life to two different offices, simply on account of the difference in medical forms, and because in one case he was asked to put the life in one of three or four classes and in the other to say how many years should be added to the age.

I consider that it would be a great step taken in advance, if the offices were to adopt one common form; and I throw out the suggestion that a joint committee of actuaries and medical officers, if one were appointed, might probably be able to submit a draft form of report which would meet with the approval of a great many companies, and in process of time come to be adopted by all. We should then, in some future investigation as to the mortality among diseased lives, feel more sure than we do at present that the aggregated experience of all the offices was based upon a similar classification of the same kinds of extra risk, and the experience of each class could be separately taken out.

In the meantime, the analysis of hospital records with regard to some of the most important diseases, such as consumption, cancer, or mitral murmurs, would assist the skilled physician in laying down on the diagram the approximately correct modification of the curve due to the incidence of each particular disease. And by the examination of a great number of such modified curves, we should see whether they might be assorted into several broad classes, thus enabling the actuary to determine the premium that it would be necessary to charge for the extra risk due to the occurrence of each type of disease.

If it be admitted that it is incorrect to measure an extra risk by the addition of years to age, a great many interesting actuarial

questions will come up for discussion and settlement. It will follow that the reserve made on the valuation of risks on unhealthy lives should not be that taken for any equivalent rated-up age, and *a fortiori* that when an unhealthy life surrenders his policy, the value should certainly not be based on any such rated-up reserve. My own opinion is, that we shall have to differentiate our reserves, just as we should do with our premiums, for the different classes of diminishing, constant and increasing risks. For the two former classes the ordinary reserve will be sufficient and we may spend our extra premium as we go along in meeting the risk that we run year by year, while, for the last class of risk, the reserve will have to be increased by the accumulation of the extra premium, so that at the fatal age, when it arrives, the blow that was foreseen should be duly provided for.

Another interesting and somewhat similar question is, what reserves should be made and what surrender values should be given for policies on lives permanently resident in tropical climates and paying a graduated extra premium for the increased risk? Here, also, I think, the practice of the offices is very dissimilar.

It will be a practical question also of considerable interest to determine in what way the necessary extra premium for a diminishing risk had best be imposed. Some offices make a certain deduction from the sum assured at death, diminishing for each year that the policy endures, until the assurance is levelled up to the ordinary rate. This seems a very practical way of meeting the extra risk, but I am inclined to think, that in fixing the deduction equivalent to the uniform whole-life extra which is assumed to be necessary, the amount is often calculated in such a way as seriously to diminish the charge which the company thinks it is imposing.

These, however, are questions which, although interesting in themselves, are apart from the main object of this paper, which is to advance the proposition, that the system of assessing lives so widely followed at present by the addition of years to the age to meet supposed extra risk is wrong in principle and misleading in practice. I shall be glad if the discussion, which I hope will ensue, enables us to come to a common determination on this topic, and clears the way for a further advance in a more correct practice.

Discussion.

The Chairman (Mr. M. N. Adler) invited discussion.

Mr. G. Humphreys thought that it was almost impossible to arrive at a mathematical demonstration of the way in which deteriorated lives should be treated. However advantageous the theoretical study of the subject might be, yet, after all, practical considerations resulting from observation and experience would in the future, as in past, go far to help them to find the right path. With regard to forms of medical report in use by British life offices, he believed the surest way of obtaining a complete medical opinion was to leave the form of the report almost entirely to the discretion of the medical officer. Mr. Chisholm had said that doctors are frequently furnished with a table of expectations as a guide. Since he examined this matter some few years ago, he had come to the conclusion that whilst it might be advisable to furnish the medical officer with a table of expectations, it was equally desirable to furnish him with other tables which would show at a glance what effect an addition to the life would have upon the expectation. Medical examiners might fairly, he thought, be called upon to say what proportion the vital power of the abnormal life bore to the vital power of the normal one at the same age. He would then be relieved from having to consider what perhaps belonged to the actuary's province. For instance, take the age of 30 with an expectation of 34·4. Supposing the medical man to say, "I think he has not more than $\frac{3}{4}$ of the vital force of the normal life at that age", they would deduct that proportion from the expectation, reducing it to 25·8, which was the expectation of 42. Therefore, to make that life equal to a normal life, 12 years should be added. With regard to Mr. Chisholm's remark, that, in certain cases, an under-average life, when it arrived at 45 was as good as any other, he did not think that at all likely. An originally rated-up life when it arrived at 45 might have the appearance of a good life, but it did not follow that it possessed the same amount of vital force as a normal life at 45, and therefore the attempt to relegate that life back to the ordinary class was, in his view, a fundamental mistake. The problem which they had to solve was what arrangements could be made so as to bring the abnormal lives on a par with the normal; and having done that, it would be highly imprudent to alter any of the terms on which those assurances were made. Mr. Chisholm stated that "Some offices make a certain deduction from the sum assured at death, diminishing for each year that the policy endures, until the assurance is levelled up to the ordinary rate. This seemed a very practical way of meeting the extra risk." He (Mr. Humphreys) did not, however, concur because it appeared that they were giving back what little benefit they had actually received. If the life died before the expected time, they did not ask that a portion of the assurance should be retained by the office. [Mr. Chisholm—I propose that they should pay more for a certain term.] But they should go on doing that, because they had merely been levelled up to the ordinary life by paying that additional premium. [Mr. Chisholm—I make them pay double.] They could not say for certain as to what age they arrived at the normal state. Was it medically possible that a deteriorated life should ever become

equal to a normal life? Of course, sometimes such lives did live as long as a normal person; but, as a rule, and as an assumption for future working, they ought to consider that no change should be made in the arrangements with which they started.

Mr. W. H. J. Whittall observed that Mr. Chisholm seemed to combine the consideration of two questions which should properly have been kept essentially separate, one being the machinery of medical examinations by which the information was acquired, and the other the principles upon which the life was assessed at the head office, and the details of the manner in which the transaction was carried out. Mr. Chisholm wished the country examiner to draw a curve of the estimated mortality, and thus assist the head office in assessing the risk; but that was hardly the department of the local medical examiner, nor could it ever be attended with useful result. The work of the local medical examiner was to put the office in possession of the true facts of the case, and to give what information they desired; but his mere *opinion* on the case was, he thought, of very little value. It was, however, the duty of the head office authorities to decide upon the eligibility of a risk. He was sure Mr. Chisholm would never succeed in getting local medical men to draw an intelligible curve on a diagram of the proposed description. Indeed he doubted whether the head-office medical officers themselves would be able to draw the curve without assistance. As to the principles regulating the assessment of lives he, like Mr. Humphreys, contested the view that the effect of a comsumptive family history disappeared at 45. If a man started handicapped in life with a bad family history he might seemingly be as good a life as possible at 45, but there would be an underlying weakness of tissue which would make its existence felt eventually, and he would not be able to bear the strain or fatigue that a man of good family history would, even when he reached 50 or 60. Actuaries ought not, he thought, to trench upon the prerogative of the medical officers. When a medical man said that a life had a very bad form of heart disease, or that from the presence of albumen in the urine there was reason to believe that he had organic kidney disease, Mr. Chisholm would not surely disregard such symptoms, and treat the question of habits as being more important. He agreed with Mr. Chisholm as to the disadvantages of rating lives up a certain number of years. There was now no doubt that the effect of that system was to assume an increased extra mortality which was small at the commencement, but grew in intensity in later years. Such a method was utterly inapplicable to a case of very bad consumptive family history. As regards the treatment by companies of under-average lives, the system of rating up applied very well to cases of increasing extra mortality. But where the extra mortality was constant the office should charge the ordinary rate *plus* a constant addition. The difficulty was greater when they came to provide for diminishing extra risk. In theory the plan of deducting a certain amount from the sum assured during the early years was a good one, but it had one great practical defect, that it was impossible to get enough extra premium out of it to meet a bad case. He had a case before him recently where double the ordinary premium was required, and in order to grant the policy under that system they would have had to

take possibly 75 per-cent off the sum assured. He, like Mr. Chisholm, could not suggest any practical means of meeting that difficulty. It did not require any proving to show that the decisions of the actuaries upon cases of difficulty were most divergent, and that was, he believed, where reform was required.

Dr. Selfe Bennett thought that the plan submitted by Mr. Chisholm as preferable to the plan which had hitherto been adopted had but few advantages from the practical point of view. The diagram, no doubt, brought prominently before the eyes of those people who were capable of comprehending it the risk which offices would run in taking any special second-class risk, and from that point of view it had advantages over the present system. But he would ask the author whether he had hitherto found any great practical objections to the system generally adopted by medical men of expressing summarily the opinion formed in their minds of the value of the life brought before them for report. He did not himself think there were any great objections to the present system, and if Mr. Chisholm's alternative were adopted it would practically amount to a much larger addition being made to the second-class lives than usual, and this would lead to a large number of second-class lives being absolutely declined by the directors, which the medical adviser felt were acceptable with an addition. Referring to the question of average or first-class lives, that standard in itself had never been actually defined. Every medical examiner for insurance would form in his mind an idea as to what the limits were within which a life must come to be entitled to rank in the first-class; and as a rule there would be very little difficulty in deciding whether any individual life came within the first-class or not. But the main difficulty which the medical examiner felt was in regard to second-class cases, in which some addition was necessary to the age to cover the extra risk. In those cases it must necessarily happen that even skilful and experienced medical men might take a variety of views. And so it would come about that cases were taken from one office to another, one office accepting them at ordinary rates, another office rating them up very highly. Mr. Chisholm had praised past times and looked back with regret upon the old days when the proposer simply went before the board of directors, who asked him a few questions and accepted him or declined him. But in second-class cases it was necessary that they should have a medical opinion, indeed, in such case the medical opinion was the only opinion which could be of value. They were not likely to get statistics, such as the author hoped for, to an extent and sufficiently reliable to enable the actuary to step in and dispense with the doctor's services. It should be left for the doctor to decide how far the life was deteriorated by family or personal history. The medical man had no desire whatever to trench upon the province of the actuary, and the majority of them always felt that they had friendly and valuable assistance from the actuary or secretary of the office. But the doctor was really the only person capable in second-class lives of assessing the amount to which they had deteriorated. Referring to the diagram he thought they had probably erred and continued to err in a number of cases, when they made small additions such as seven or ten years to cases where the risk was, as the author

pointed out, run within the next twenty years. Those offices, though they were very few, were, he believed, more rational in their estimate of such cases which added fifteen or twenty years, and even more, especially when they were of consumptive family history.

Mr. E. A. Colquhoun said that the question Mr. Chisholm had treated was a most difficult and obscure one. The question what extra should be charged was so purely personal that wide differences must always occur. Still, something might be done to make the practice of companies more uniform. The tabulation of private investigations would do much to remove the wide discrepancies known to occur. But the great difficulty of personal considerations would always remain. Rated-up lives must be divided into two or three broad classes. Probably the division adopted by Mr. Meikle in his investigation as to second-class lives in the Scotch companies was as good a one as could be found. He divided the cases into two classes—family and personal history. With regard to family history, consumption was the great taint. Dr. Reginald Thompson had exhaustively treated of this subject in his work on "Phthisis." He (Mr. Colquhoun) believed that, assuming the life otherwise good, a small extra rating would, as a rule, meet any risk from family history. It was otherwise in personal history. In these cases the rating must be heavy, such as an addition of ten or fifteen years. Small additions were worse than useless; they only irritated the supporters of the company without affording adequate protection. He believed gout required a higher rating than that usually imposed. Another class of cases which it was dangerous to deal with consisted of those in which the medical officer disliked the case on general but indefinite grounds. He knew of a case a year or two ago of a life being rejected by one company on the ground of "general flabbiness." This was the doctor's term. Shortly after it was passed by another company. The life died in a few weeks after reaching the Soudan, of exposure. Albuminuria and heart disease were cases which were more leniently treated now than they were a few years ago. He knew of a case in which albuminuria had been noticed, but was treated as transient, and the life accepted at the ordinary rate after a year or two. So in heart disease. Some cases were accepted at an addition, where the heart sounds, though not normal, were believed to be constitutional. The general conclusions he had come to were that a family taint would show itself sooner or later, and that it was an advantage to both parties that the medical adviser and the actuary should discuss the rating and its financial effect together.

Dr. F. De H. Hall felt quite certain that the average medical man in the country would not understand this diagram, and they would be less likely to get a clear opinion if such a table were submitted to him than if he was simply requested to say whether the life was above or below the average. At the same time some table of this sort would be very suggestive; it would certainly point out to medical men that there were certain diseases, notably consumption, in which the mortality took place at a comparatively early period, certainly under 50; whereas there were other diseases—notably Bright's disease—in which the mortality was to be looked for above that period. A diagramatic table would point that out very clearly. A

table might perhaps be drawn out showing the different diseases with, say, red ink for consumption, showing a high mortality in the first twenty or thirty years, and blue ink for Bright's disease, so that at a glance a medical man would see the incidence of those diseases. As regards the question of medical examination for first-class lives, he agreed with Mr. Chisholm in saying that there were certain cases in which there may be albuminuria, and others in which there may be irregularity of the heart, of a transitory character; but he did not gather that Mr. Chisholm meant that cases of aortic regurgitation should be taken as simply showing that there was some trifling irregularity of that organ. Amongst certain young adults transitory albuminuria did occur, and the same held good in heart affections. No doubt numbers of men had been rejected simply for some trifling irregularity of the heart, which perhaps a little over-exertion or nervous excitement had brought out. Mr. Chisholm had referred to the analysis of hospital records. Information thus obtained would not, he thought, be of any use for assurance purposes. This was brought very pointedly before him by a remark made by Sir Andrew Clark in a paper read at the Medical Society eighteen months ago, in which he said he had been very much amused at the prognosis of young hospital physicians. There was no doubt young hospital physicians did take too gloomy a prognosis in most cases. The cases brought into hospitals were the worst cases, and a large number of them died under their observation. It was forgotten that the patients they saw at hospitals had been exposed to many bad influences, whereas the patients they saw in private practice had been able to take things easily and quietly. Heart disease, for instance, in the class of people who resorted to hospitals was very different indeed to heart disease in the upper fifty thousand. It would, therefore, be quite fallacious to expect any assistance from hospital statistics so far as insurance was concerned. He thought the simplicity of the reports a very desirable matter for attention, but it would not do to carry simplicity too far. He had recently added in his own office the phrase "Urine after examination", and had been struck by the number of reports upon urine. Possibly urine might not have been examined before, but he insisted upon the absolute importance of having the report of the urine in every case; the specific gravity, the time it was taken, the reaction of the urine, the presence and absence of sugar and of albumen, should be specifically noted. Anything short of that, to his mind, was insufficient to meet the requirements of the case.

Dr. Tirard said that Mr. Chisholm appeared to take two opposite views. First of all, that they ought to do without medical examination entirely; and, secondly, that they ought to make the medical examiners much more strict in their work than they have hitherto been. As to the first, cases had come under his notice where he was practically certain that an undesirable life would have been accepted at the ordinary rate had he come before the board of directors, as of old. Lately he congratulated a man on his excellent physique, and immediately afterwards found his urine nearly solid with albumen. A case like this would on aspect alone have passed, not only a board of directors, but also any medical examination provided the urine was not examined. With respect to the table that Mr. Chisholm had placed

before the meeting, it dealt only with consumption. But if they were to have anything as complete as this with regard to one disease, they ought to have it as complete with regard to others. The table merely referred to consumption in the family and stated nothing as to the personal examination of the individual. Even as it stood it was too much to expect from a country medical practitioner. The fact was, that if they were to have anything more nearly approaching completeness, they would need to get it from the chief medical officer and not from medical examiners whose function should be merely to accumulate facts, to put them forward for the information of the office and to say what their general impression was as to the eligibility of the life. After this, the chief medical adviser should mark the cases so as to give information to the board of directors in some way which should convey to them a clear idea as to his opinion of the life. He ought not to think about any number of years, or any amount to be added. When the cases had been carefully analyzed, it should be left to the actuary in concert with the directors to determine what amount of extra premium, if any, should be charged.

Dr. Jas. E. Pollock said that the type of the best assessment of life must be made by the doctor and the actuary. Having had a good deal of experience as to advice for life assurance purposes, he considered that country practitioners should be regarded as a class who were not competent to give forecasts. They were able to give facts and groups of facts, but they were not able to give the intellectual forecast on which the actuary would need to rely. He did not, of course, refer to the large class of highly-educated practitioners in the large towns. He would have the principal medical adviser at the head office receive all the reports from the country, and would have him assign the medical value to those medical reports; he should then communicate thereon the actuary of the company, and these two should jointly assess the risk. Such a course would secure the unity that was so desirable, and save them from so many miserable failures. As regards the forms of reports, he believed such forms had better be more simplified. He had lately seen the forms of an office in which there was a regular treatise on life assurance, which gave information as to how to test for albumen, how to hold the tube, where to put the nitric acid, where to apply the lamp. He thought the more complex the form the worse it was. He would simplify the form but would ask the doctor to go through all the organs. He would ask him in all cases to examine the urine and report as regards albumen, sugar and the other ordinary constituents. As a profession, medical men were not quite competent to take the actuarial part of the work and assign values, but they could be greatly guided by the actuaries, and the more they acted with them the better for the offices. There were, truly, risks which increased at age and others which diminished. No doubt, consumption decreased after 45, and he believed it was the rule of several offices not to charge extra for consumptive family history after 45, and they were pretty safe as a rule. There was no doubt also, that gout was a cumulative risk; it accumulated after a certain period. Therefore there were increasing risks at certain periods and diminishing risks, and if the actuaries could guide the physicians to estimate the relative value of those risks, it might be found possible so to adjust them that medical knowledge and actuarial knowledge might work together.

Dr. Allchin said that it did not seem to him that the interpretation which had been put upon the paper by previous speakers was that which it was originally intended to bear by Mr. Chisholm. As regards the diagram, the real position of that matter was to be found in this remark in his paper:—"The difficulty in the case first arises when the doctor wishes to convey to the minds of the directors, the information that he has obtained and the impression it makes upon him. He can easily report the simple facts—that the life has had such and such an illness, that after careful questioning he is of opinion that one of the parents died from such and such an hereditary disease—but how to put in words the exact feeling in his mind of the way in which and the extent to which the life has deteriorated, is not so simple a matter." Those words contained the exact point. Gentlemen who were admitted as being able to ascertain certain facts, had to endeavour to convey the results of their examination to the minds of unprofessional persons. In the endeavour to make the knowledge that the physician had acquired available to persons who did not understand the subject, some such diagram as that which had been proposed would be exceptionally valuable. He did not appreciate the difficulties that had been raised in respect of the diagram. He entirely differed from the views that had been expressed with regard to the inefficiency of country practitioners, and their ability to comprehend the nature and value of the diagram; and thought that there was a very large proportion of provincial doctors who would be perfectly qualified to understand, and make proper use of it. The diagram was not intended to replace any expression of opinion, but merely to show exactly what the doctor meant when he described technically the character of the risks in any special case. For that purpose the diagram was, he thought, especially valuable; and it further had the great advantage that it might lead to a uniform way of looking at these matters. It would be a common ground of considering the subject, and the want of that common ground was a great want indeed on the medical side. Doctors could get at the facts, but it was the way to express the value of those facts in the estimation of the probability of life that was so necessary. Besides, such a form would lead to more accurate ideas being formulated than was suggested by the vague expressions of "a life of this class", or "that class", when no definitions of what these classes really were existed. He thought that anything which tended to the more intimate association of the medical examiner and the actuary in arriving at a judgment as to the value of any and every life, was most strongly to be encouraged. The ultimate result should be a compound of their special knowledge and opinions which should be regarded as complementary to one another, and being so, this result should be sought for by concerted effort.

Mr. G. H. Ryan pointed out that there was a certain amount of ambiguity and indefiniteness in the paper. In the first place, it was not expressed with absolute clearness whether Mr. Chisholm would have the diagram sent out with every medical report, or whether he would reserve its use for special cases. If the former, the probable effect of his suggested course, would be that there would be far fewer cases accepted at the ordinary rate, because medical referees who had

such a form placed before them, would feel the necessity of showing that they understood it by varying the curve of mortality. On the other hand, a form of that description might be of considerable advantage in large cases in which the amounts would give them special importance, because it showed, perhaps more fully than any other form of diagram or any verbal expression, the true incidence of the risk. The chief objection to the use of the diagram appeared to be that no one at a glance could see what financial effect the drawing of a curve in any particular form would have upon the premium. He doubted whether Mr. Chisholm himself could tell how the lower curve, drawn upon his special diagram, would affect the premium for the risk. Now when the medical officers, in concert with the actuaries, were deliberating as to what extra premium should be charged upon a special risk, it must often become a question of judgment and a matter of discussion how the extra hazard should be assessed. The difference between two alternative estimates might under our existing system, erroneous though it be, very clearly be seen by reference to the prospectus of rates; but if they were to draw two alternative curves upon the diagram, it would be impossible, without much elaborate calculation, to tell the respective effect of such arrangements. Therefore, in the majority of cases the diagram and the method generally suggested by Mr. Chisholm would not be practicable. He dissented from the opinion of Mr. Humphreys and Mr. Whittall, that the method of limiting the amount assured in special instances for a certain term of years was inapplicable. Mr. Whittall had stated that he recently had a case before him in which, if such a system had been adopted, it would have been necessary to reduce the sum assured by something like 75 per-cent. But there was not only one variable quantity. There were two variables. They could operate upon the sum assured, or upon the premium, or upon both functions at the same time, and if Mr. Whittall had suitably increased the premium for the risk, and also adopted the expedient of temporarily reducing the sum assured, he might have placed the matter on a fair and reasonable basis. It seemed to him far more desirable that they should give the proposer an option of paying their terms, however high they might appear, than that they should decline him altogether; because, when they made use of that form of decision they virtually implied that they did not possess sufficient knowledge or skill to enable them to measure the risk. They ought to be loth to admit that.

Dr. Symes Thompson said he was one of those who doubted whether Mr. Chisholm's diagram could be advantageously circulated throughout the length and breadth of the land. It might be used by those offices that are accustomed to carry out a few insurances on selected lives, but he questioned whether it would be generally applicable among offices which had a very large number of lives insuring for small amounts. There were cases which, now and then, would make such a table highly advantageous, in evidence of which he instanced the case of a contingent insurance on a young life against an old, where the family history of the former was unsatisfactory. The risk was a short risk, but that short time would comprise the period when the greatest risk to the younger life would occur. Now,

by looking at a diagram, it would be possible to point out to the actuary and the directors, that the danger of accepting such a risk would be very great indeed, that there would be no excessive danger in accepting that risk for the whole life, but that to accept it for a short period would be excessively dangerous. So that there were instances in which such a diagram as this would be of service. It might be an advantage for the consulting medical officer of the society to have a curve formed, and he personally, would be inclined to look through some of the claims which take place in his office with a view to forming a curve, and ascertaining whether the curve so made at all corresponded with the course of events. With reference to the forms sent out for medical examination, he thought that simplicity was all important.

The Chairman (Mr. M. N. Adler), in proposing a vote of thanks to Mr. Chisholm, said that probably in fifty years' time they would come to look upon the prevailing practice of assessing such special risks as one of the exploded ideas of former days. One point to which Mr. Whittall alluded ought not to escape attention. It was this, that the rating-up of lives merely met the case where the extra risk of mortality was at an increasing rate as the life got older; but where the extra risk was stationary or decreasing, the rating-up, properly so-called, did not apply, and some other method must be devised to meet the case. There were various ways of doing this. An endowment assurance might meet the case, because the endowment assurance was made up of two distinct parts—that of the term assurance, and that of the payment at a certain date—and the two ran in different directions. Mr. Makeham established the fact that an increase in the portion of the premium for the term risk was greater than under a whole-life assurance. On the other hand, the endowment portion of the premium should be diminished as the risk of the life surviving the given age was lessened by the assumed increase of mortality, and under these circumstances no extra premium need necessarily be imposed. But there were other ways of meeting extra risk, such as requiring a high premium, payable not for life, but only for a limited term, or letting the time for participation be delayed, or, as already suggested, granting an increasing assurance at the rate required for a uniform assurance for the maximum amount.

Mr. Chisholm, in reply, said that his object had been mainly to elicit a discussion, and therefore he had put certain statements in his paper in such a form as to draw forth remarks. He deprecated the idea that he had intended, in any degree, to depreciate the services of the members of the medical profession. He, further, never intended to suggest, as a practical matter, that they should dispense with the medical examination, but in approaching the subject he had considered how far any medical examination was necessary. Referring to the remark made by Mr. Humphreys that it was impossible to relegate an under-average life again to the ordinary class, that was a view in which he quite agreed, and he did not propose to do so. But in the case of a conflict of opinion as to the justice of an extra, where, for instance, a company thought a life ought to pay 5 or 10 years extra, and the life thought he ought to pay none at all, he could not see why, if it pleased the assured, they should not charge him

double the amount for a certain specified shorter term. In theory it was quite correct to do so, and he had known cases where it would suit the company better to adopt this mode, and besides be very satisfactory to the assured—for instance, those cases where the risk came at the commencement, and where the double premium was obtained in the shape of deduction from the sum assured. It came to the same thing, whether a deduction from the sum assured, or an increase in the rate was made—the assured liked the former course better, and as the company got a fair amount of premium, it suited both parties. With regard to the remark made by Mr. Whittall, that sometimes the extras would come to be so heavy as to be practically unreasonable, he thought that would only be in extreme cases. In the majority of cases the initial reduction of the sum assured would not exceed 50 per-cent, and it would vary from 25 to 50 per-cent, going on diminishing until it was wiped out altogether. Mr. Whittall had stated that they had no business to go to the doctor for the purpose of assessing the value of the risk. If that was so, the present practice was altogether wrong, for they did actually ask the doctors to assess the value of the lives. If it were wrong to do so, they ought to correct their practice. Seeing that the practice existed, he had suggested some better way of getting at the doctors' minds. The whole discussion should lead to a general agreement on one point, namely, that in fixing the premium which any life had to pay, it was necessary that the actuary and chief medical officer should consult together, that on the one hand the medical officer should not say how many years shall be added to the life or what price should be paid, and on the other hand that the actuary or the board of directors should not attempt what would be for them the impossible task of fixing the amount of deterioration in a life. The difficulty was to find out a common platform on which the actuary and medical officer could meet. With that view his diagram was drawn up—as a common platform on which doctors and actuaries could consult and mark their impressions of the life in such a form that it would be possible to see what sort of extra premium they ought to get for the risk. He looked upon it as most important that they should approach the medical profession in some common way. They would know better what they were doing in the future in investigations into invalid mortality, and be more likely to classify the lives on a uniform plan if they had a common form of medical report. In this form a few heads were, perhaps, all that was necessary; but the point was to get at the feeling in the doctor's own mind, and if they could, by consultation, agree upon doing so in a common way, he imagined it would be better for themselves, for their classification of disease, and more agreeable to the medical profession.

Further Reply by Mr. Chisholm.

[Reprinted from the *Insurance Record*, 16 April 1886.]

On reviewing the foregoing discussion, it would seem that there has been an entire misconception on the part of some of my actuarial brethren both of the scope and of the object of the paper. In assessing the value of a life, there are three processes to be gone

through necessarily consecutive in point of time. The first is the correct ascertainment and presentation of the facts by the medical examiner; the second is the correct appreciation of these facts by the actuary and directors; and the third is the rating of the risk. With this third point my paper did not attempt to deal. I wished to consider in the first place whether our modes of taking the *measure* of the risk were correct before discussing how a rating should be applied, and any reference in the paper to the question of rating, it will be seen, was used only to show the absurd results that followed from an incorrect mode of measuring the risk to begin with. There have been many papers previously submitted to the Institute on the question of rating, but these all accepted as a fundamental fact the existing practice of measuring the amount of depreciation in a life by the addition of a number of years to age. So far as I am aware, no previous paper has dealt as a separate subject with the question of the proper mode of measurement of the individual risk, and as this is the initial step in the whole process of assessment, and any defect in this part of our practice would vitiate all the results that might be subsequently deduced, I considered that the issue would be very much simplified by excluding all questions of rating from the discussion. I am sorry if the short title which I gave to my paper has led to this misconception. I thought that I had made the matter clear by my mode of treating the subject, and by expressly stating at the close of the paper that questions of reserves and rating would come on for subsequent discussion. The great bulk of the life assurance business that is transacted is procured by offices which have their lives examined in all parts of the country by medical examiners who have no special training in assurance business. Experience has shown us the difficulty of being satisfied with a bare statement of the facts. It is necessary in some shape or form to ask the opinion of the medical examiner as to the bearing of the facts, and many companies have been driven to ask him to state by how many years he considers the life worse than the average. I hold that this is expecting a great deal too much from the medical examiner, that it is, in fact, an absurd question to put to him, and that we have no right even to ask it of ourselves. In order to get over the difficulty we are all of us in, the diagram was suggested. I can see the objections to its ready acceptance by the medical profession, but I cannot help thinking that its use would necessitate a clearer definition in the mind of the medical examiner himself of the risks that certain lives presented, and would lead to a lessening of the difference of opinion between him and the chief medical officer and the actuary in town. This in itself would be a great gain. At present we encourage the country medical examiner by the questions we put to him to form a final and conclusive opinion on the life, and he naturally finds fault with us if his advice is not taken. I should further add, that my modified curves traced on the diagram are not intended to be used as rigid bases for framing the premiums to be charged. The diagram would simply be substituted in the usual form of medical report in lieu of the question asking the doctor to give his final opinion, with the view of eliciting more clearly what his impressions were of the value of the life, and the curve drawn would be made use of in conjunction with the other facts reported, to enable the chief medical officer and the actuary to decide what kind and what amount of rating should be applied.

History of Life Assurance in the United Kingdom. By Cornelius Walford, F.I.A.

(*Continued from* p. 271.)

3.—Period of Scientific Exactitude.

We commence our third epoch with the year 1721, and with the fact that there was at that period but one Life Assurance Office in existence in Great Britain—the *Amicable,* founded 1706. That too, so far as we have the means of knowing, was the only Life Assurance Association in the world. It was very defective in its mode of working, at the best; but it stood alone. The Society had at this date an accumulated fund of about £50,000; it had distributed in death claims £118,000. Thus it had obtained a solid hold upon public confidence, but I suspect its business suffered considerably from the general shock to public credit. The days of Mutual Contribution Life Assurance Associations, as such, were gone for ever in England. This Society had to take steps to mitigate the element of uncertainty, or it would most probably have died out. Solidity was now the one thing sought for.

This solitary survivor was not long to remain in undisturbed possession of the field. In the June of the preceding year there had been founded under very special circumstances,* two powerful Corporations for the transaction of Marine Insurance business—the *London Assurance Corporation,* and the *Royal Exchange Assurance Corporation.* On the 29th April, this year (1721), they each obtained additional legal powers, whereby they were enabled to accept Life Assurance risks, on the ground that it had been found advantageous for persons having offices and employments, to effect assurances on their own lives and those of others.

Each of these corporations, under the powers of their additional Charters, commenced to issue Life policies. Here are the details of the first five issued by the *London Assurance,* as it was then usually designated.

"1721. June 7th.—William, Lord Bishop of Sarum, on
" Cheverton Hartop, Esqre., of Quarendon,
" County Leicester, aged about 31 years, for one
" year at 5 per-cent—£200.

"July 20.—Henry Baynes, Esqre., of the City of
" York, on the Life of Henry Baynes, of Clifford's
" Inn, aged about 26 years, for one year at 5
" per-cent—£500.

* I do not recount the circumstances here; they are so widely known.

"August 8th.—Elizabeth Bookey, of St. Andrew's,
" Holborn, on the Life of William Bristowe, of
" the Six Clerk's Office, aged about 25 years, for
" one year at 5 per-cent—£300.

"August 10th.—Robert Allen, of the Inner Temple,
" on the Life of William Humphrey, of the
" Twelfth Division, London Brewery Exciseman,
" aged about 28 years, for one year at 5 per-
" cent—£70.

"Sept. 25th.—Kingsmill Eyres, Esqre., on the life of
" Captn. Edward Murray, on the half-pay list,
" aged 55, for one year at £6. 5*s*. 0*d*. per-cent."

These policies were all effected, obviously, for business purposes; not one as a family provision in the form now understood. The rates in the earlier cases were very high, in the latter not so. The equalized annual premium for the last case would now be about £5. 2*s*. per-cent without profits; 10*s*. more with. But in these early days the office deducted 2 per-cent from the sum insured, as the early Life Underwriters had done.

The Form of Contract (Policy) then in use indicated but little, if any, advance upon those I have already given (see 1583 and 1699). It was still upon the model of the Contract of Marine Insurance, and was what would then be understood as a "Valued Policy", which signifies that the sum insured was the agreed value of the interest the person effecting the insurance had in the life of the insured, and hence, the insurers could not raise any question thereon. There was a proviso of forfeiture in case of "voluntary" breach of the conditions of insurance. The age of the insured is not stated in the contract; nor was it of such direct consequence where the premium (£5. 5*s*. 0*d*.) was not progressive with age, and was frequently three times greater than the actual risk demanded.

A full copy of this policy (No. 12, Government Stamp 3*s*. 10*d*.) is given in this *Journal* (xxii, 248), and hence, it seems hardly necessary to reproduce it here.

With regard to the rate of premium, the *Amicable* Society was at this date charging an "entry fee" of £3. 15*s*. 0*d*., in addition to £4. 4*s*. 0*d*. premium—the death shares had averaged less than £100 at this date. Real Life Assurance was still, therefore, an expensive luxury. It will be remembered that Mr. Babbage, at a later period, endeavoured to discover the circumstances which led to the fixing of 5 per-cent premiums, and came to the conclusion that it

probably arose from its appearing, that the annual number of deaths in London was nearly one in 20 of the population. I confess to thinking that the rate had not even this basis of calculation to support it; the underwriters were accustomed to charge £5 per-cent for the ship, and so named £5, the same rate, for the captain's life. This rate became traditional.

Life Assurance as a domestic institution, if not actually killed by the events of 1720, was thrown back at least one full generation. By what processes it became revived, it will be our next purpose to trace.

In 1725 De Moivre published his work, *Annuities upon Lives:* or *the Valuation of Annuities upon any number of Lives, as also of Reversions. To which is added an Appendix concerning the Expectation of Life, and Probabilities of Survivorship.* In this work he propounded a method of calculating annuity values on a much simpler process than that which Halley had adopted. This proposal afterwards became developed into what is known to actuaries as "De Moivre's Hypothesis": consisting of the assumption that any specified number of persons born would be subsequently decreased from age to age, by some uniform number of deaths. From this it was evident that as the number of deaths was supposed to be invariable, so such number would annually be in greater proportion to the diminishing number of survivors, and thus consistently represent at successive ages, a yearly decrease in the probabilities of life.

In 1726 John Smart published the large edition of his well known *Interest Tables,* to which he appended a few remarks on Annuities upon Lives.

A small edition of Smart's Tables had been published as early as 1707. Herein he gave what may be termed a Hypothetical Table of Mortality for London—the first of its kind.

In 1727 Richard Hayes published *A New Method of Valuing Annuities on Lives.* It has been previously noted, that to him appears to be due the origination of the "whole-term" assurance principle. He puts for solution the case "To provide for a "family: A clergyman or layman, aged 47 years, holding a "benefice or place during life, and having a family, would "willingly make some certain provision for them; but finding "that his income will let him lay up about £46 a year, and that "upon no better security than his own uncertain life, therefore "chooses to sell the surplusage of his income—what is it worth?"

In 1730 there was published: The Gentleman's Steward and

Tenants of Manors Instructed, &c. *The Tables for valuing Estates on Lives being founded on Dr. Halley's Hypothesis, and calculated by the method laid down by Mr. Abr. De Moivre to* 4, 5, 6, 7 *and* 8 *per-cent, &c.,* by John Richards. This author, although no mathematician, had the acuteness to perceive that the true method of valuing Leases for Lives was really dependent upon specific calculation, and that the imaginary estimates currently adopted frequently proved entirely fallacious. He accordingly gave, in popular form, a series of Tables, calculated upon the principles laid down by Halley and De Moivre, and which were of great practical utility.

Mr. Lawrence, Mr. Gael Morris, and Mr. Weyman Lee, all published works upon Leases and Annuities about the same period; and each (except the latter, who fell into a misapprehension of an untenable character) conferred benefit in promulgating correct views upon these questions.

In 1740 Mr. Thomas Simpson published *The Nature and Laws of Chance,* &c., &c., a work which was, to a very considerable extent, an abridgment of De Moivre's; and which, being published at a much smaller cost, obtained a considerable circulation. And being thus known, he published in 1742: *The Doctrine of Annuities and Reversions deduced from general and evident principles, with useful Tables, shewing the values of Single and Joint Lives,* &c. He seems to have foreseen that the Doctrine of Life Contingencies was destined to be extensively employed at a future time, and that consequently more real utility would result from endeavouring to discover general demonstrations applicable to *all* Tables of Observations that might be produced from time to time, than from inventing particular hypotheses, which, however interpretative of contemporary data, might cease to be useful if new data should arise. He expressed a view which, no doubt, had been generally felt and acted upon, namely, that Breslau, "a place where the generality of the people live to a "greater age than at London (as appears by comparing the Bills "of Mortality here with those observations) *can be no just* "measure of the probability of Life in this place" [London]. He accordingly prepared a *Mortality Table for London,* showing what he believed to be the true rate of mortality for this City, which differed from that produced by Smart in 1726.

Other works followed of a similar character, such as Hodgson's *Calculation of Annuities on Lives deduced from the London Bills of Mortality,* &c., and Corbyn Morris's *Essay towards Illustrating*

the Science of Assurance (1747), *and Short's New Observations,* &c. (1750), and other editions of the works already noted; but the main result desired had been accomplished. Mortality Tables had been constructed on English data, and the essential principles of Life measurement were now generally understood in England.

ACTUARIAL NOTE.

On the Rate of Mortality among Europeans in Tropical Africa. By THOMAS BOND SPRAGUE, M.A., *President of the Institute of Actuaries.*

THE Insurance Offices have occasionally to quote extra premiums for residence at various places in Tropical Africa, such as the West Coast, Sierra Leone, Zanzibar, Lake Tanganyika, &c., but they have, I believe, very little information as to the real risk attaching to such residence. It will therefore probably be useful to them to know what has been the rate of mortality which has prevailed among the white employees at the Stations on the Congo River, as deduced from statistics contained in Mr. H. M. Stanley's book entitled *The Congo and the Founding of its Free State,* publisht this year. In volume 2, page 306, he gives the following table, exclusive of the last column which I have myself added:

Year	Number of Whites Engaged	Number of Deaths from Sickness	Number of Deaths from Accidents	Returned from various Causes	Remaining in the Service at the end of the year	Number Exposed to Risk
1879	18	2	...	4	13	8
1880	13	2	...	7	28	15
1881	13	1	...	7	32	19
1882	33	3	2	12	69	31·5
1883	93	8	2	25	151	71
1884	83	7	...	37	142	118
1885	10	1	1	...		
TOTAL	263	24	5	92	...	262·5

There is no explanation as to the manner in which the figures in his last column, "Remaining in the service at the end of the year", are obtained, and I am unable to reconcile them with the others; the only coincidence I can trace being that the total Number of Whites Engaged (263), is equal to the sum of the 29 Deaths, 92 Returned from various causes, and 142

Remaining in the service at the end of the year 1884. But it is obvious that this 142 is the number remaining, not at the end of 1884, but at the date in 1885 to which the return of entrants and deaths is made up.

If we treat the figures in the usual way, assuming that the men engaged in each year were under observation on the average for one half of that year, and the number returned were also under observation for one half of the year in which they returned, except the 4 who returned in 1879, being the year in which they engaged, whom I assume to have been under observation for only 3 months each on the average, we get the figures shown in the final column.* The year 1885 is excluded, because the statistics for that year are not complete. We thus get a total of 262·5 years of life; and corresponding to these, 27 deaths; the rate of mortality being thus 10·3 per-cent. Mr. Stanley says that, although the mortality was very high at first, there has been an improvement in recent years; but the figures he has given do not bear out this opinion.

All the employees, Mr. Stanley says, were men in the prime of life, and were in perfect health on their arrival at the Congo. His work contains much interesting and valuable information as to the causes of the heavy mortality which has prevailed, and as to

* The following figures explain how the numbers exposed to risk were deduced:

Year	Brought forward from previous year		Entered in the year		Died and Returned in the year		Past on to the next year
1879	0		18	–	6	=	12
1880	12	+	13	–	9	=	16
1881	16	+	13	–	8	=	21
1882	21	+	33	–	17	=	37
1883	37	+	93	–	35	=	95
1884	95	+	83	–	44	=	134

Calculation of the Number at Risk in each Year.

Year	Under Observation at beginning of year		Half the Number Engaged in the year		Half the Number Returned in the year		Exposed to Risk in the year
1879	0		9	–	1	=	8
1880	12	+	6·5	–	3·5	=	15
1881	16	+	6·5	–	3·5	=	19
1882	21	+	16·5	–	6	=	31·5
1883	37	+	46·5	–	12·5	=	71
1884	95	+	41·5	–	18·5	=	118
							262·5

the precautions which should be adopted to reduce the risk from the climate. Those who desire full particulars, must read the book for themselves; and it will be sufficient to state here that Mr. Stanley is of opinion that it is a popular error to suppose that malaria is the principal cause of the fevers which are so fatal to Europeans in Africa. According to his observation, the fatal illnesses result from chills caused by exposure to wind after being heated by exertion, and from imprudent use of stimulants. These, he says repeatedly, should never be touched by a European in Tropical Africa during the day time, but may be beneficially taken in moderation after sunset.

No doubt many of those who returned from the Congo to Europe, came back with shattered constitutions, and died early; and the general conclusion from the figures seems to be that the extra premium for the Congo should be not less than ten guineas per-cent per annum. According to Mr. Stanley, Sierra Leone is still more unhealthy.

CORRESPONDENCE.

ASSURANCES ON x AGAINST y AND t YEARS LONGER.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—As premiums for assurances on x provided he die before y or within t years after him, are frequently required in connection with reversionary transactions, I thought it would be useful to have a table by which the addition to be made to the ordinary survivorship net premium to cover the risk of x dying within t years after y, could be readily determined, instead of making an arbitrary addition as is sometimes done in consequence of the labour of computing it. I have therefore calculated that addition by the H^M Table at 4 per-cent interest for decennial ages, and $t=1$, 3, 5, 7, and 10, (1) when the premium is payable until the risk determines, and (2) when it is payable during the joint existence of the lives only, and trust that you will find space for the tables in your valuable *Journal*. For the calculation of the annual premium for x before y or within t years after him, when it is payable until the risk determines, I used the formula

$$\frac{A_x - \frac{D_{x+t}}{D_x}\{A_{x+t} - A_{x+t.y}^{\;1}\}}{1 + a_x - \frac{D_{x+t}}{D_x}\{a_{x+t} - a_{x+t.y}\}},$$

and the substitution of a_{xy} for the expression in the denominator gave the annual premium payable during the joint existence of the lives only. I calculated the survivorship premiums by the ordinary formula; and as I believe these have not hitherto been published, I append a table of them also for decennial ages.

I should have liked, if possible, to have made the calculation by Mr. Sprague's Select Tables in combination with the $H^{M(5)}$; but as the joint-life annuities by these tables are not tabulated, and the calculation had to be kept within practicable limits, I had to abandon the idea. I may mention that I had 216 values of $A^{1}_{x+t.y}$ to compute before I was in a position to commence the calculation of the addition to the survivorship premium, and I also append a table of some of these values in the hope that they will prove serviceable. I have made some calculations, however, with the view of ascertaining what addition would have been made to the Select and $H^{M(5)}$ survivorship premiums had these tables been used in the calculation; and it may be interesting to give a few of the results, and compare them with those by the H^{M} Table. The Select premium for 40 against 70 is ·01098 and the H^{M} ·01149; while for 70 against 40 they are ·08991 and ·09541 respectively, and for 30 against 30, ·01354 and ·01315. The Select premiums if 40 die before 70 or within 3, 7, and 10 years after him, payable until the risk determines, are ·01196, ·01331, and ·01435 respectively, the additions to the survivorship premium being therefore ·00098, ·00233, and ·00337 respectively, which are considerably greater than those given in my table, namely, ·00072, ·00182, and ·00273. The Select premiums for 40 against 70 or within 3, 7, and 10 years after him, payable during the joint existence of the lives only, are ·01500, ·02038, and ·02437 respectively, the additions to the survivorship premium being therefore ·00402, ·00940, and ·01339 respectively, which agree very closely with those given in my table, namely, ·00401, ·00934, and ·01333. I believe that, when the premium is payable during the joint existence of the lives only, the addition will be almost exactly the same as that given in my table, but that, when the premium is payable until the risk determines, the addition will be greater, except when one—or both—of the lives is young.

Mr. Meikle has given (*J.I.A.*, iv, 134) a method of approximating to the premium for x against y and t years longer. His formula is (using modern notation) $P^{1}_{xy}+P^{1}_{xy.|t}A_{x+z}$, where $z=e_{xy}$. Here it will be noticed that, when the premium is payable during the joint existence of the lives only, the addition to the ordinary survivorship premium is $P^{1}_{xy.|t}A_{x+z}$, that is to say, the annual premium which will provide a temporary insurance on x for t years after the joint existence has failed, provided it is dissolved by the death of y. I give some of the additions calculated in this way, and it will be observed that the results by his approximate method agree fairly well with the exact values given in my table; but as the formula assumes a table of the expectation of two joint lives to have been formed, it cannot be readily applied. For 40 against 70, and $t=1, 3, 5, 7$, and 10, the additions, using first differences, would be ·00128, ·00384, ·00637, ·00887, and ·01266 respectively, as against ·00134, ·00401, ·00668, ·00934, and ·01333 by my table. When the premium is payable until the risk determines, however, the above formula should not be multiplied by $\frac{1+a_{xy}}{1+a_{x}}$, as stated by him, but by $\frac{1+a_{xy}}{1+a_{\overline{y(t)}.x}}$.

I take this opportunity of submitting another solution of the problem, in the belief that it will be more readily followed by the younger readers of the *Journal*.

Required the present value of an assurance of 1 payable if x die before y or within t years after him.

(1) During the first t years the insurance would be paid whether x died before or after y, and we have ${}_{|t}A^1_{xy}+{}_{|t}A^2_{xy}={}_{|t}A_x$. (2) After t years the insurance would be paid in any year, say the $(t+n)$th, if x die in that year and y be alive t years previously, that is to say, on the average at the middle of the nth year. The value of the second part is therefore

$$\Sigma v^{n+t}\frac{d_{x+t+n-1}}{l_x}\cdot\frac{l_{y+n-\frac{1}{2}}}{l_y}$$

$$=v^t\frac{l_{x+t}}{l_x}\Sigma v^n\frac{d_{x+t+n-1}}{l_{x+t}}\cdot\frac{l_{y+n-\frac{1}{2}}}{l_y}$$

$$=v^t{}_tp_x\mathrm{A}^{\ 1}_{x+t.\,y}.$$

The total value of the assurance is therefore

$${}_{|t}\mathrm{A}_x+v^t{}_tp_x\mathrm{A}^{\ 1}_{x+t.\,y}.$$

It may be useful to point out that Mr. Curtis Otter, in solving this problem (*J.I.A.*, vii, 240), speaks of the payment in the nth year when it is evidently the payment in the $(t+n)$th year which is meant.

I am, Sir,
Your obedient servant,
JAMES CHATHAM.

Scottish Equitable Life Assurance Socy.,
Edinburgh, 7th December, 1885.

Table showing the Addition to $100\varpi^1_{xy}$ *to cover the Risk of x dying within t Years after y, when the Premium is payable until the Risk determines,*—$100(\varpi^1_{x:\overline{y(t)}}-\varpi^1_{xy})$. H^{M} 4 *per-cent.*

x	y	$t=1$	$t=3$	$t=5$	$t=7$	$t=10$	x	y	$t=1$	$t=3$	$t=5$	$t=7$	$t=10$
20	20	·008	·026	·042	·058	·080	50	20	·008	·024	·041	·058	·085
	30	·010	·030	·049	·070	·099		30	·015	·043	·071	·098	·137
	40	·009	·027	·046	·067	·098		40	·026	·077	·126	·173	·239
	50	·007	·022	·039	·057	·085		50	·039	·118	·197	·273	·381
	60	·007	·021	·035	·051	·075		60	·045	·142	·243	·347	·502
	70	·007	·021	·035	·049	·072		70	·047	·148	·258	·373	·555
30	20	·011	·028	·045	·061	·084	60	20	·007	·025	·044	·066	·097
	30	·014	·041	·068	·094	·131		30	·013	·040	·070	·100	·142
	40	·016	·048	·081	·114	·164		40	·024	·074	·123	·172	·237
	50	·014	·044	·076	·109	·163		50	·045	·137	·225	·310	·424
	60	·011	·038	·066	·095	·143		60	·069	·216	·363	·505	·702
	70	·012	·037	·062	·089	·131		70	·090	·284	·486	·690	·985
40	20	·008	·026	·042	·059	·082	70	20	·011	·034	·061	·088	·121
	30	·015	·045	·074	·102	·139		30	·014	·048	·085	·119	·162
	40	·023	·069	·114	·158	·220		40	·023	·077	·133	·183	·244
	50	·027	·081	·138	·194	·280		50	·046	·146	·243	·329	·430
	60	·024	·077	·134	·193	·288		60	·091	·279	·460	·620	·808
	70	·023	·072	·125	·182	·273		70	·158	·490	·808	1·092	1·432

Table showing the addition to $100\varpi^1_{xy}$ *to cover the Risk of x dying within t Years after y, when the Premium is payable during the joint existence of the Lives only,*—$100\left\{\frac{A^1_{x:\overline{y(t)}}}{a_{xy}} - \varpi^1_{xy}\right\}$. H^M 4 *per-cent.*

x	y	$t=1$	$t=3$	$t=5$	$t=7$	$t=10$	x	y	$t=1$	$t=3$	$t=5$	$t=7$	$t=10$
20	20	·018	·055	·088	·120	·163	50	20	·033	·091	·143	·194	·258
	30	·023	·068	·111	·152	·212		30	·047	·133	·210	·279	·368
	40	·026	·079	·129	·180	·253		40	·074	·210	·333	·442	·584
	50	·032	·095	·157	·218	·308		50	·114	·331	·532	·717	·961
	60	·045	·132	·216	·297	·415		60	·163	·484	·794	1·092	1·507
	70	·069	·203	·331	·454	·630		70	·232	·694	1·153	1·607	2·273
30	20	·024	·065	·104	·139	·187	60	20	·043	·124	·194	·255	·329
	30	·031	·091	·148	·200	·272		30	·061	·169	·264	·345	·444
	40	·039	·117	·191	·264	·367		40	·093	·261	·406	·529	·676
	50	·047	·142	·235	·326	·462		50	·160	·450	·702	·918	1·179
	60	·061	·184	·304	·422	·597		60	·269	·775	1·230	1·631	2·133
	70	·091	·270	·443	·613	·861		70	·429	1·260	2·042	2·766	3·725
40	20	·026	·074	·118	·159	·213	70	20	·070	·184	·277	·349	·424
	30	·038	·111	·178	·239	·318		30	·088	·239	·358	·450	·545
	40	·056	·164	·265	·360	·487		40	·127	·345	·517	·647	·780
	50	·075	·222	·365	·503	·699		50	·219	·594	·888	1·111	1·336
	60	·096	·289	·480	·669	·949		60	·415	1·132	1·704	2·145	2·596
	70	·134	·401	·668	·934	1·333		70	·773	2·154	3·300	4·212	5·183

Table of ϖ^1_{xy}. H^M 4 *per-cent.*

x	y	ϖ^1_{xy}	x	y	ϖ^1_{xy}	x	y	ϖ^1_{xy}
20	20	·01004	40	20	·02127	60	20	·05526
	30	·00913		30	·02012		30	·05455
	40	·00823		40	·01823		40	·05310
	50	·00748		50	·01580		50	·05010
	60	·00686		60	·01344		60	·04505
	70	·00635		70	·01149		70	·03858
30	20	·01432	50	20	·03333	70	20	·09697
	30	·01315		30	·03239		30	·09645
	40	·01168		40	·03056		40	·09541
	50	·01024		50	·02746		50	·09304
	60	·00905		60	·02350		60	·08812
	70	·00811		70	·01963		70	·07966

Table of A^1_{xy}. H^M 4 *per-cent.*

x	y	A^1_{xy}	x	y	A^1_{xy}	x	y	A^1_{xy}	x	y	A^1_{xy}
20	20	·1715	35	20	·2693	50	20	·4205	65	20	·6166
	30	·1475		30	·2413		30	·3994		30	·6045
	40	·1211		40	·2002		40	·3602		40	·5813
	50	·0944		50	·1517		50	·2940		50	·5310
	60	·0682		60	·1051		60	·2097		60	·4385
	70	·0448		70	·0661		70	·1299		70	·3095
25	20	·1979	40	20	·3129	55	20	·4828	70	20	·6839
	30	·1712		30	·2864		30	·4650		30	·6744
	40	·1395		40	·2433		40	·4305		40	·6564
	50	·1069		50	·1863		50	·3661		50	·6156
	60	·0760		60	·1280		60	·2723		60	·5335
	70	·0489		70	·0791		70	·1734		70	·4028
30	20	·2313	45	20	·3639	60	20	·5494	75	20	·7468
	30	·2031		30	·3399		30	·5345		30	·7395
	40	·1662		40	·2975		40	·5057		40	·7258
	50	·1262		50	·2341		50	·4471		50	·6942
	60	·0887		60	·1626		60	·3504		60	·6261
	70	·0567		70	·1000		70	·2336		70	·5051

ON THE ANALOGY BETWEEN AN ANNUITY-CERTAIN AND A LIFE ANNUITY.

To the Editor of the Journal of the Institute of Actuaries.

SIR,—The analogy existing between an annuity-certain and a life annuity has been remarked upon by Mr. G. King, in his interesting note in Volume xx of the *Journal* (p. 435), and Mr. James Chisholm in the preface to his recently-published *Tables of Policy-Values.* Both of these writers have investigated the subject on the assumption that the annuities were payable once a year, and little remains to be said upon the matter from this point of view. But the assumption of annual intervals makes it necessary that the functions should be manipulated before their similarity can be demonstrated; while even then, the analogy, in one respect (compare expressions (3) and (4), *J.I.A.*, xx, 436), appeals to the intelligence rather than to the eye. A far stricter resemblance—indeed, a complete and exact coincidence—will, however, be found to exist between the two functions, and between other cognate functions depending upon the same elements, when we regard them as being payable continuously, or by momently instalments. The following formulas attest the truth of this assertion, and may be considered of some interest to students of actuarial science.

On the assumption that the interest is convertible, and the annuity payable, momently, we have

$$\bar{a}_{\overline{n}|} = \frac{1-\epsilon^{-n\delta}}{\delta}.$$

Here $\epsilon^{-n\delta}$ represents the present value of 1 to be received at the end of n years on the conditions specified, and is really the single payment necessary to secure the unit at the expiration of this period. As

$P_{\overline{n}|}$ has, by a high authority, been chosen as the symbol to express the annual payment to provide for the return of the unit at the end of n years, we may, with some convenience and propriety, write $A_{\overline{n}|}$ for the corresponding single payment. For the continuous values, we should then have $\bar{P}_{\overline{n}|}$ and $\bar{A}_{\overline{n}|}$, according to accepted precedent. The formula above given would accordingly become

$$\bar{a}_{\overline{n}|} = \frac{1-\bar{A}_{\overline{n}|}}{\delta}.$$

It is necessary, as a further preliminary, to bear in mind the self-evident relation

$$\bar{P}_{\overline{n}|} \,.\, \bar{a}_{\overline{n}|} = \bar{A}_{\overline{n}|}.$$

These considerations are all that are required to establish the undermentioned parallel equations:

1. *Annuities-certain; and Whole-Life Annuities (continuous),*

$$\bar{a}_{\overline{n}|} = \frac{1-\bar{A}_{\overline{n}|}}{\delta}, \text{ or } \frac{1}{\bar{P}_{\overline{n}|}+\delta}; \text{ and } \bar{a}_x = \frac{1-\bar{A}_x}{\delta}, \text{ or } \frac{1}{\bar{P}_x+\delta}.$$

2. *Single Payments; and Single Premiums (continuous),*

$$\bar{A}_{\overline{n}|} = 1-\delta\bar{a}_{\overline{n}|}; \quad \text{and} \quad \bar{A}_x = 1-\delta\bar{a}_x.$$

3. *Annual Sinking Funds; and Annual Premiums (continuous)*

$$\bar{P}_{\overline{n}|} = \frac{1}{\bar{a}_{\overline{n}|}} - \delta; \quad \text{and} \quad \bar{P}_x = \frac{1}{\bar{a}_x} - \delta.$$

4. *Accumulation of Sinking Funds; and Policy-Values (continuous),*

$${}_t\bar{V}_{\overline{n}|} = 1 - \frac{\bar{a}_{\overline{n-t}|}}{\bar{a}_{\overline{n}|}}; \quad \text{and} \quad {}_t\bar{V}_x = 1 - \frac{\bar{a}_{x+t}}{\bar{a}_x}.$$

In no case is there the least want of agreement in the form of the corresponding expressions, but an undeviating similarity exists in every detail. The explanation of the coincidence of the formulas is, of course, obvious. When we deal strictly with annual payments the expressions cannot be literally analogous, seeing that in assurance benefits the annual contribution, or premium, is always assumed to be payable in advance, whereas in the other case the annual contribution, or sinking fund, is commonly payable at the end of the first year, or period. But by adopting continuous values, the points of time at which the first payments respectively become due are made to coincide. By no other means can the expressions be reduced to an identical form, and I am therefore disposed to think that the analogy between assurance and compound-interest functions can best be illustrated by the aid of the continuous values.

An important conclusion to be drawn from the identity of these formulas is that, if tables of single and annual premiums were computed on the same lines as *Orchard's Tables*, but upon the continuous basis, they could be employed indifferently for obtaining assurance or compound-interest values.

I am, Sir,

Your obedient servant,

London, March 1886. GERALD H. RYAN.

INDEX TO VOL. XXV.

A.

ACTUARIAL NOTES:

On the Value of the Option of Second Nomination in Reversionary Annuities. G. F. Hardy, 134.
Value of Endowment Assurance on Joint Lives, 136.
On the Rate of Mortality in Central Africa. T. B. Sprague, 437.

Analogy between an Annuity-Certain and a Life Annuity, On the. G. H. Ryan, 443.
Assessment of Life Risks, On the. J. Chisholm, 408.
Assurances on x against y and t years longer. J. Chatham, 439.
Average Rates of Mortality, as affected by the Groupings of the Numbers exposed to Risk at different Ages, On. W. T. Gray, 369.

B.

Bailey (A. H.). On the Income Tax, especially in reference to its Incidence on Assurance Companies, 314.
Burridge (A. F.). Some Account of the Census from 1801 to 1881, 83.

C.

Census from 1801 to 1881, Some Account of the. A. F. Burridge, 83.
——— Returns, G. F. Hardy on the Rates of Mortality among the Natives of India as deduced from the recent, 217.
Central Africa, T. B. Sprague on the Rate of Mortality in, 437.
Charter of Incorporation of the Institute of Actuaries, The Royal, 1.
Chatham (J.). On Assurances on x against y and t years longer, 439.
Chisholm (J.). On the construction of Models of Policy-Values, and on a New Method of comparing the Reserves for Policies according to different Tables of Mortality and Rates of Interest, 141.
——— On the Assessment of Life Risks, 408.

CORRESPONDENCE:

W. Sutton on Errata in the *Institute of Actuaries' Text-Book*, Part I, 63.
T. B. Sprague on the Solution of a Problem, 277.
——— on "Asset"—"Outgo", 366.
J. Chatham on Assurances on x against y and t years longer, 439.
G. H. Ryan on the Analogy between an Annuity-Certain and a Life Annuity, 443.

Crisford (G. S.). On Office Premium Loadings, and how they are dealt with under the Various Methods of Valuation, and modes of Distribution of Profits, 184 and 387.

D.

Death Losses for the eight years ending 31st December, 1884, in the Union Mutual Life Insurance Company, Report of Dr. T. A. Foster on the, 251.

Discussion on the Report of the Royal Commission on Friendly Societies, 36.

E.

Endowment Assurance on Joint Lives, Value of, 136.
Errata in the *Institute of Actuaries' Text-Book*, Part I, Letter from Mr. Sutton on, 63.
Errata, 368.

F.

Foster (Dr. T. A.). Report upon the Death Losses of the Union Mutual Life Insurance Company for the eight years ending 31 December 1884, 251.
Friendly-Society Legislation, Notes on, 24, 216.

G.

Graduation of Mortality Tables, J. A. Higham on the, 15, 245.
Gray (W. T.). On Average Rates of Mortality as affected by the Groupings of the Numbers exposed to Risk at different Ages, 369.
Godefroi (H.). On Mortgages of Reversionary Interests, 55.

H.

Hannyngton, The late Major-General J. C., Obituary of, 367.
Hardy (G. F.). On the Value of the Option of Second Nomination in Reversionary Annuities, 134.
——— On the Rates of Mortality among the Natives of India, 217.
Higham (J. A.). On the Graduation of Mortality Tables, 15, 245.
History of Life Assurance in the United Kingdom. C. Walford, 114, 207, 257, and 433.
Hodge, The late W. B., Obituary of, 367.

I.

Income Tax, especially in reference to its Incidence on Assurance Companies, A. H. Bailey on the, 314.
Incorporation of the Institute of Actuaries, The Royal Charter of, 1.
India, G. F. Hardy on the Rates of Mortality among the Natives of, 217.

Institute of Actuaries—
Examination Papers, 1885. Preliminary, 278; Intermediate, 281; Final, 284.
Proceedings, Session 1884-5, 287.
Annual Report, 289.
Income and Expenditure for the year ending 31st March 1885, and Balance Sheet 31st March 1885, 291.
Opening Addresses by the President (T. B. Sprague), 65, 293

Insurance, State Supervision in. Abstract of a Paper by Mr. R. Teece, 350.

J.

Joint Lives, Value of Endowment Assurance on, 136.

L.

Law Reports:
Last *v.* The London Assurance Corporation, 327.

Life Assurance Companies of the United Kingdom, The, 271.
——— History of, in the United Kingdom. C. Walford, 114, 207, 257, and 433.
Life Risks, On the Assessment of. J. Chisholm, 408.
Loadings, Office Premium, and how they are dealt with under the Various Methods of Valuation and Modes of Distribution of Profits. G. S. Crisford, 184 and 387.

M.

Marriage. T. B. Sprague on the probability that a Marriage entered into at any time will be Fruitful, and that if a Marriage has been Childless for several years it will afterwards become Fruitful, 160.
Memoir of Augustus De Morgan, 137.

Miscellanea:
Obituary, 367.
New Publications in 1885, 368.
Errata, 368.

Models of Policy-Values, On the construction of, and on a new Method of Comparing the Reserves for Policies according to different Tables of Mortality and Rates of Interest. J. Chisholm, 141.

Mortality Tables, J. A. Higham on the Graduation of, 15, 245.
——— in the Navy, T. B. Sprague on the Rate of, 49.
——— among the Natives of India. G. F. Hardy, 217.
——— in Central Africa, T. B. Sprague on the Rate of, 437.
——— as affected by the Grouping of the Numbers exposed to Risk at different Ages, On Average Rates of. W. T. Gray, 369.
Mortgages of Reversionary Interests, H. Godefroi on, 55.

N.

Navy, T. B. Sprague on the Rate of Mortality in the, 49.
New Publications in 1885, 368.
Notes on Friendly-Society Legislation, 24, 216.

Notices of New Books:

Memoir of Augustus De Morgan, 137.

O.

Obituary:

The late Wm. B. Hodge, 367.
——— Major-Gen. J. C. Hannyngton, 367.
——— Cornelius Walford, 367.
——— Elizur Wright, 367.

Office Premium Loadings, and how they are dealt with under the various Methods of Valuation and Modes of Distribution of Profits. G. S. Crisford, 184 and 387.

Original Tables:

Tables of $\varpi^1_{x:\overline{y(t)}}-\varpi^1_{xy}$, $\frac{A^1_{x:\overline{y(t)}}}{a_{xy}}-\varpi^1_{xy}$, ϖ^1_{xy}, and A^1_{xy} (H^M 4 per-cent). J. Chatham, 439.

R.

Report of the Royal Commissioners on Friendly Societies, Discussion on the, 36.
Reserves for Policies, J. Chisholm on the Construction of Models of Policy-Values, and on a New Method of Comparing the, 141.
Reversionary Interests, Mortgages of, H. Godefroi on, 55.
Ryan (G. H.). On the Analogy between an Annuity-Certain and a Life Annuity, 443.

S.

Sprague (T. B.). Opening Addresses as President, 65, 293.
——— On the Rate of Mortality in the Navy, 49.
——— On the Probability that a Marriage entered into at any age will be Fruitful, and that if a Marriage has been Childless for several years it will afterwards become Fruitful, 160
——— On the Solution of a Problem, 277.
——— On "Asset"—"Outgo," 366.
——— On the Rate of Mortality in Central Africa, 437.
State Supervision in Insurance. R. Teece, 350.
Sutton (W.). Letter on Errata in the *Institute of Actuaries' Text-Book*, Part I, 63.

T.

Tables, Mortality, J. A. Higham on the Graduation of, 15, 245.
Teece (R.). State Supervision in Insurance, 350.

V.

Value of the Option of Second Nomination in Reversionary Annuities. G. F. Hardy, 134.
——— of Endowment Assurance on Joint Lives, 136.

W.

Walford (C.). History of Life Assurance in the United Kingdom, 114, 207, 257, and 433.
——— Obituary Notice, 367.
Wright, Elizur, the late, Obituary of, 367.

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Total Amount of Claims upon Death	£2,707,129
Amount of Profits divided at the Quinquennial Bonus on 1st June	£486,000

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45	36	3	4
50	43	13	4

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SUBSCRIBED CAPITAL	**£1,500,000**
ANNUAL INCOME	**£339,265**
NET NEW PREMIUMS in 1885	**£10,752**

The following figures show the progress of the Company :—

In 1877 the Assurance Fund, invested upon first-class securities, was equal to **32** per cent. of the Sums Assured and Bonus added thereto; and to 11 times the amount of the Annual Premiums payable.

In 1882 to **36** per cent. of the Sums Assured and Bonus added thereto; and to 13 times the Annual Premiums payable.

In 1885 to **37** per cent. of the Sums Assured and Bonus added thereto; and to 13 times the Annual Premiums payable.

In June, 1877, the amount of Profits declared by the Company was **£183,883**

In December, 1882 . . . . . **£218,182**

In addition to the Bonus declared periodically, interim Bonuses *are given on Policies of five years old and upwards which become claims between any two valuations, thereby practically securing to the Assured an Annual Bonus.*

During the past 38 years the Company has paid in Claims **£8,141,532**

And divided Bonuses amongst the Assured, exclusive of those taken in Reduction of Premium, amounting to **£1,077,794**

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ASSETS, £2,062,652. EXPENSES OF MANAGEMENT, £8,217.

The Reserve retained by the Society in respect of its Liabilities under Policies has been calculated according to the HIGHEST STANDARD, viz., the Tables of the Institute of Actuaries, interest being taken at 3 per cent., and all the loading on premiums reserved.

NINE-TENTHS of the Total Profits are divided among the Assured. Considerably more than One-tenth of the Profits is derived from Policies which do not participate in Profits, so that the Assured have larger Bonuses than if they formed a Mutual Insurance Company, and received the whole of the Profits derived from their own Policies.

At an Extraordinary General Meeting held on May 19, 1885, the sum of £1,565,574 was set aside as the value of the Society's Liabilities under its Assurance and Annuity Contracts, and **£339,325 was ordered to be divided as Bonus**; leaving a Balance of undivided Profit of £89,823.

Nine-tenths of the sum divided was allotted among holders of **Policies for £3,520,862.**

TABLE of TOTAL ADDITIONS made up to December 31, 1884, *to POLICIES of* £1,000 *each.*

Age at Entry.	NUMBER OF PREMIUMS PAID.																							
	Forty.			Thirty-five.			Thirty.			Twenty-five.			Twenty.			Fifteen.			Ten.			Five.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
20	*1,022	0	0	*876	0	0	*736	0	0	567	10	0	431	0	0	299	0	0	191	10	0	103	0	0
30	*1,167	0	0	*978	10	0	*819	0	0	*623	10	0	464	10	0	325	10	0	211	0	0	112	0	0
40	*1,343	10	0	*1,124	10	0	*939	10	0	*710	0	0	525	10	0	365	10	0	232	0	0	124	0	0
45	*1,454	10	0	*1,225	10	0	*1,017	0	0	*769	10	0	*567	10	0	393	10	0	250	0	0	133	0	0
50	..			*1,355	0	0	*1,126	0	0	*851	0	0	*626	10	0	435	0	0	276	10	0	147	0	0
55	..			..			*1,285	0	0	*970	0	0	*715	0	0	497	10	0	316	10	0	168	0	0
60	..			..			..			*1,130	10	0	*836	10	0	*582	0	0	372	0	0	197	10	0

In the cases marked (*), the Bonuses, if surrendered, would be more than sufficient to extinguish all future premiums, and the Policy-holders would still be entitled to share in future profits.

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